Vema's Brachiopoda (Recent)

G. ARTHUR COOPER

SMITHSONIAN CONTRIBUTIONS TO PALEOBIOLOGY · NUMBER 17

SERIAL PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

The emphasis upon publications as a means of diffusing knowledge was expressed by the first Secretary of the Smithsonian Institution. In his formal plan for the Institution, Joseph Henry articulated a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This keynote of basic research has been adhered to over the years in the issuance of thousands of titles in serial publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Annals of Flight
Smithsonian Contributions to Anthropology
Smithsonian Contributions to Astrophysics
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Studies in History and Technology

In these series, the Institution publishes original articles and monographs dealing with the research and collections of its several museums and offices and of professional colleagues at other institutions of learning. These papers report newly acquired facts, synoptic interpretations of data, or original theory in specialized fields. These publications are distributed by mailing lists to libraries, laboratories, and other interested institutions and specialists throughout the world. Individual copies may be obtained from the Smithsonian Institution Press as long as stocks are available.

S. Dillon Ripley
Secretary
Smithsonian Institution

SMITHSONIAN CONTRIBUTIONS TO PALEOBIOLOGY • NUMBER 17

Vema's Brachiopoda (Recent)

G. Arthur Cooper

SMITHSONIAN INSTITUTION PRESS
City of Washington
1973

ABSTRACT

G. Arthur Cooper. *Vema's* Brachiopods (Recent). *Smithsonian Contributions to Paleobiology,* number 17, 51 pages, 5 figures, 9 plates, 1973.—Brachiopods dredged on the worldwide exploratory cruises of R/V *Vema,* of the Lamont-Doherty Geological Observatory of Columbia University, are important in expanding knowledge of brachiopod distribution and taxonomy. Thirty-two species are identified, of which six are new. Twenty-one genera are represented, one of which is new. The species of five genera and the genera of two lots could not be determined. The majority of the brachiopods were taken from waters deeper than 100 fathoms. One specimen of *Abyssothyris* was dredged from the greatest depth (6179 meters=20,267 feet) from which a brachiopod has been taken.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year.* SI PRESS NUMBER 4789. SERIES COVER DESIGN: The trilobite *Phacops rana* Green.

Library of Congress Cataloging in Publication Data
Cooper, Gustav Arthur, 1902–
Vema's Brachiopoda.
(Smithsonian contributions to paleobiology, no. 17)
Bibliography: p.
1. Brachiopoda. 2. Vema (Research vessel)
I. Title. II. Series: Smithsonian Institution. Smithsonian contributions to paleobiology, no. 17.
QE701.S56 no. 17 [QL395] 560'.8s [594'.8] 72–10017

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 Price $1.00 (paper cover)

Contents

Vema's Brachiopoda (Recent)

G. Arthur Cooper

Introduction

In the fall of 1962 I was invited to study the Recent brachiopods taken by the *Vema,* research vessel of the Lamont-Doherty Geological Observatory of Columbia University. All of the deep-sea dredgings taken by this vessel were turned over to the American Museum of Natural History for sorting and distribution to interested parties. It was through the Museum that the offer to study these specimens was made. The work of the Geological Observatory is famous for its complete coverage of the world's seas. Consequently the opportunity to study a collection made by such a far-ranging vessel seemed an unparalleled opportunity. And so it proved, because the collections include a great variety of specimens from all depths and many parts of the world. In the collection 22 genera and 32 species are present. In addition five genera could not be identified as to species, but are nevertheless described. In numbers of species taken, the collections of the *Vema* exceed those of the world-famous collections of the British exploring vessel *Challenger.*

Recent brachiopods are commonly thought of as very rare animals, and this is indeed true when compared to the hosts of the molluscan faunas that occupy all realms of the oceans today. Although rare in this sense, the brachiopods are far more widely distributed and in greater variety than hitherto understood. They are known from all parts of the world, and in local areas they may even dominate a bottom as the most abundant member of the fauna. Some places in the Antarctic (Foster 1968:160) abound in brachiopods almost to the exclusion of other mega-invertebrate animals. The worldwide revival of interest in the seas by many of the major countries and the intensive dredging programs now under way will revolutionize knowledge of modern brachiopods.

It is a pleasure to acknowledge the help of Dr. Ernst Kirsteuer, Associate Curator of the American Museum of Natural History. Thanks are extended to Mr. Gerald W. Thurmann, who sorted the samples. I am also grateful to Dr. Meredith Jones, formerly of the American Museum of Natural History, who proposed this study. I also thank Dr. Kirsteuer and Dr. Merrill W. Foster, Bradley University, Peoria, Illinois, for critically reading the manuscript and offering helpful suggestions.

The voyages of the *Vema* on which the brachiopods described herein were collected would not have been possible without the financial support granted to Lamont-Doherty Geological Observatory of Columbia University by the National Science Foundation and by the U.S. Navy, Office of Naval Research, under contract N00014–67–A–0108–0016.

Geographic Distribution of the Collection.— For the most part biological sampling was performed by the R/V *Vema,* but in 1956 a second vessel, *Theta,* was used and in 1961 and 1962 a Chilean vessel *Yelcho* was employed. The latter two vessels obtained brachiopods from only three

G. Arthur Cooper, Department of Paleobiology, Smithsonian Institution, Washington, D. C. 20560.

stations. The number of each station is preceded by the first initial of the research vessel. In the case of the *Vema,* a V followed by the cruise number and that by the dredge or sample number, each unit separated by a hyphen.

> The usual sampling gear utilized [was] a "standard benthic trawl," a dredge whose opening is approximately one meter wide and about 15 centimeters high, to which nylon netting is attached. Other collecting gear includes a so-called pebble dredge (PD in station number column to the left), a rock dredge (RD in the station number column) and large diameter cores (LDC). SAT refers to a series of trawls taken off South Africa in 1958. [Notes accompanying the collection.]

In the series of cruises of each vessel only a few localities produced brachiopods. In the experience of the *Challenger* only 39 stations out of a total of 361 produced brachiopods. The cruises of the Lamont-Doherty vessels produced a similar experience. The first cruise of the *Theta* across the Atlantic from near the Canary Islands to north of Bermuda took brachiopods in only one sample. *Vema*–12 found brachiopods in only two dredgings out of fifteen. *Vema*–14 made 58 dredgings in the South Atlantic and Indian Oceans and took brachiopods in eight of them. *Vema*–15 dredged in the South Atlantic and North Atlantic and took brachiopods in 32 out of 165 stations. *Vema*–16 dredged in the South Atlantic at 66 stations and produced brachiopods at 11 of them. *Vema*–17 went along the west coast of South America and part of the Antarctic north of the South Shetland Islands and on north into the Atlantic. This expedition dredged 120 samples and produced brachiopods in 29 of the dredgings, for the richest collecting. Brachiopods were taken by *Vema*–18 in a route down the east side of South America, producing 10 brachiopod samples out of 128 dredgings. *Yelcho* produced two lots with brachiopods from the Antarctic.

Although collecting in areas that are well known for their brachiopods, such as the Strait of Magellan, did not produce new material, the distribution of some genera was distinctly widened. What appears to be *Cryptopora gnomon,* a North Atlantic species, was taken north of the Falkland Islands. *Chlidonophora incerta* appears in mid-Atlantic between Africa and South America. *Abyssothyris* species was taken at greater depth than that of any brachiopod hitherto found, i.e., 6179 meters (=20,267 feet). *Argyrotheca* was taken off Brazil with *Terebratulina latifrons,* which brings these Caribbean elements farther south than previously known. *Dyscolia* was taken in the South Atlantic, a considerable extension of its range from the West Indies and Indian Ocean.

The *Vema* collections brought to light specimens of obscure or poorly known species. *Macandrevia tenera* was previously known from only a few specimens. Its type in the British Museum (Natural History) is a badly damaged specimen.

In any collection of Recent brachiopods there is likely to be a number of specimens that defy classification because they are bizarre variants or because they may have new structures or an unfamiliar combination of morphological features. This collection includes such material. In some instances the specimens have been referred to genera without specific identification.

BATHYMETRY OF THE COLLECTION.—It is generally believed that the greatest diversity of brachiopods is found in the shelf areas around the continents (Schuchert, 1911; Zezina, 1970). Zezina states that the "overwhelming majority of brachiopod species live at depths of down to 500 meters." The continental shelves are generally taken by geologists to terminate with the 100 fathom (about 200 meters) line. Using this depth as the limit of shallow water, the brachiopods collected by the *Vema* are divided as follows: 12 confined to waters less than 200 meters; 6 other species live in these shallow waters but extend into deeper water; and 19 species were taken from water deeper than 200 meters. There appear to be few brachiopods whose ranges are fixed, and many species have very wide latitude in their depth tolerance. *Hemithiris psittacea* ranges from the shallow-water zone of 200 meters down to 2078 meters. *Liothyrella uva* (as identified herein) ranges from 112 meters to 562 meters. The range of *Macandrevia tenera* is from 300 to 2452 meters. *Magellania venosa* usually occurs in shallow water from 22 to 207 meters, most commonly between 15 and 100 meters. Several lots, all of them of immature specimens, range from 257 meters to 1362 meters. There is always a possibility of misidentification of immature specimens of the long-looped brachiopods. *Aneboconcha* ranges from shallow water to 947 meters.

Pelagodiscus atlanticus, Cryptopora gnomon, Chlidonophora incerta, and *Macandrevia tenera*

have ranges approximating or exceeding 2000 meters.

Disposition of the Collection.—All of the figured specimens are in the National Museum of Natural History of the Smithsonian Institution. Some of the unfigured paratypes are in the American Museum of Natural History, New York, together with a labeled set of specimens. Duplicates of the more abundant species are in the National Museum of Natural History.

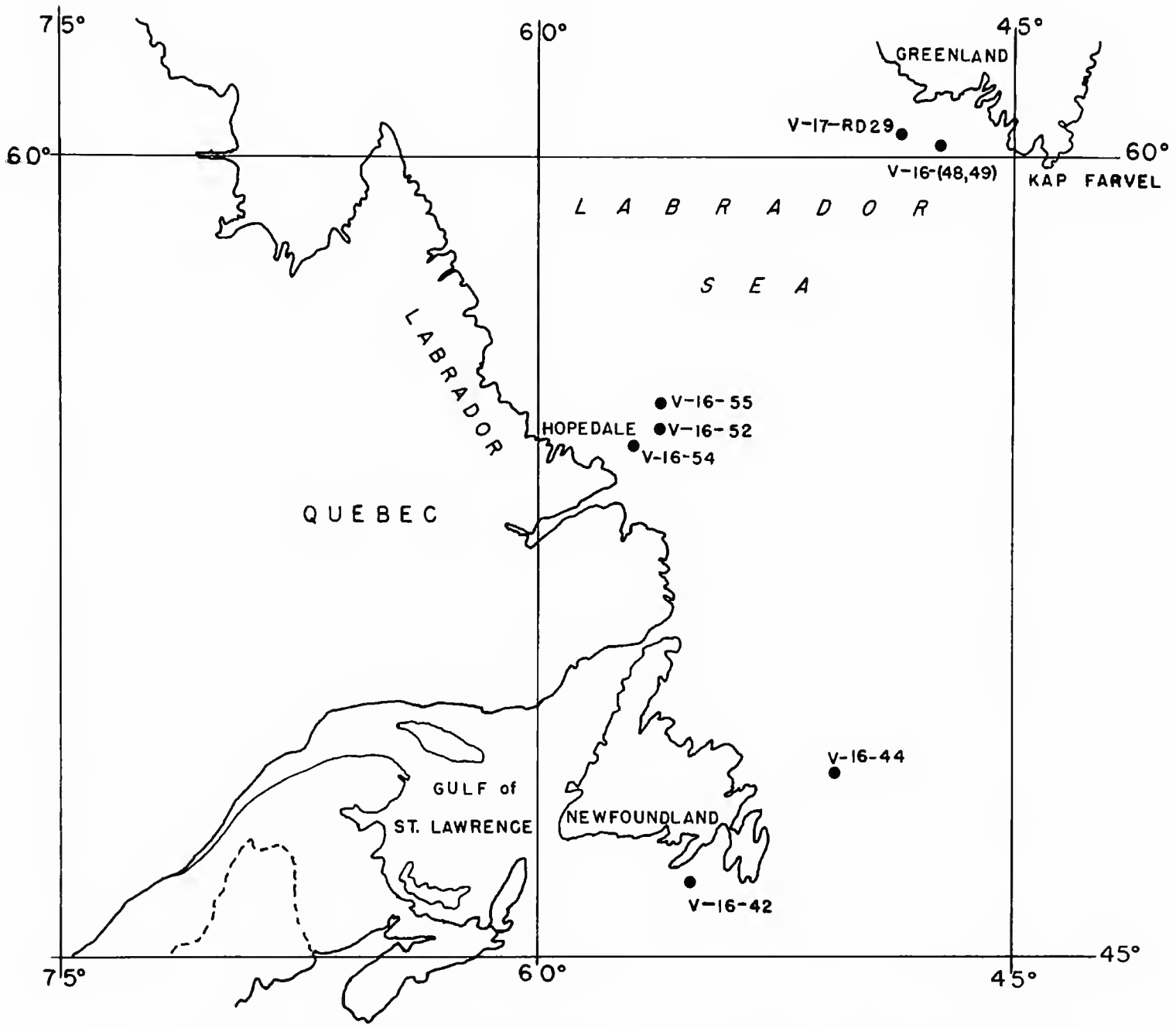


Figure 1.—Part of the North Atlantic, showing stations from which brachiopods were taken.

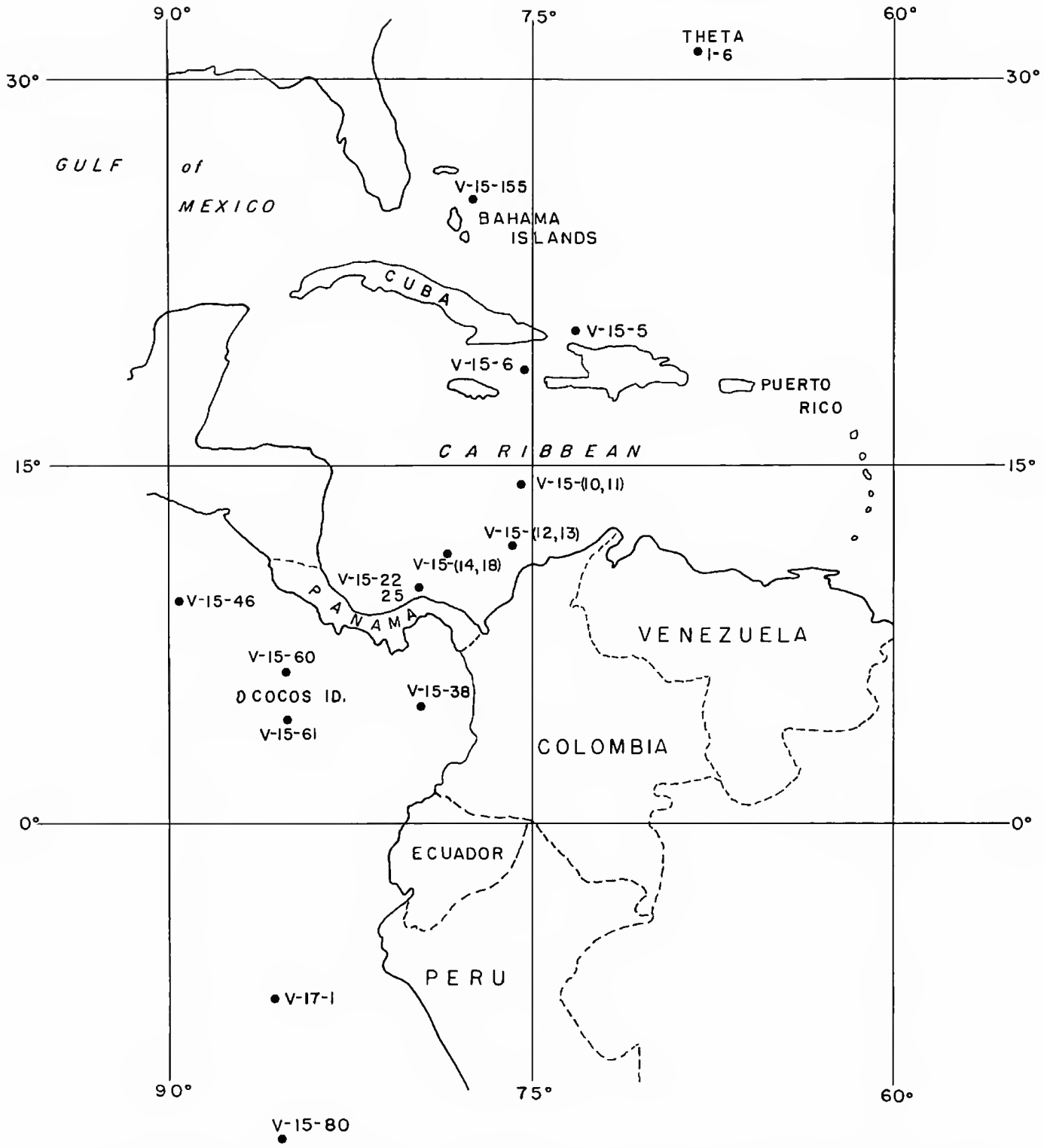


FIGURE 2.—The Caribbean Sea and northwestern South America, showing location of dredging stations where brachiopods were found.

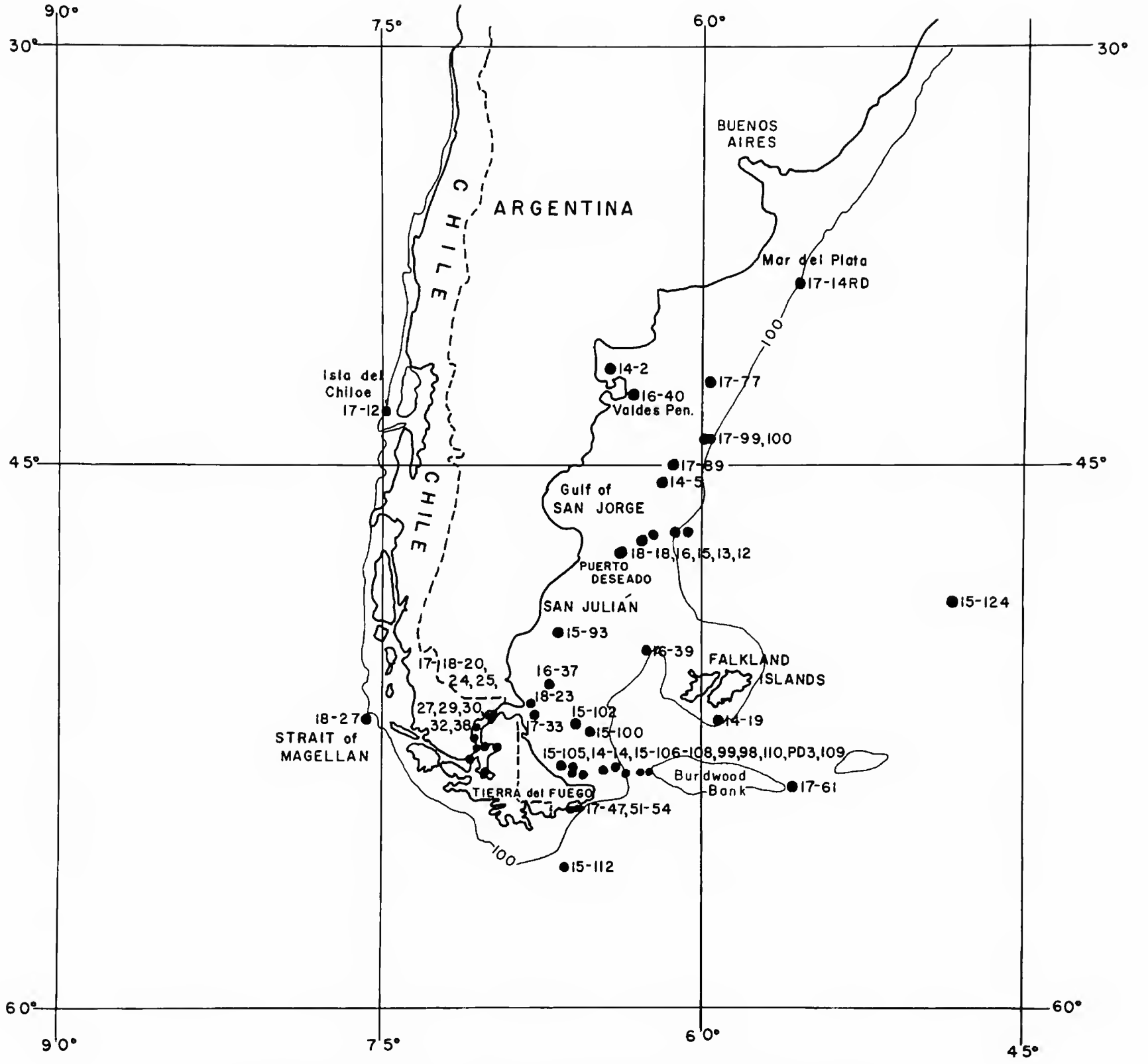


FIGURE 3.—Southern part of South America, showing brachiopod localities.

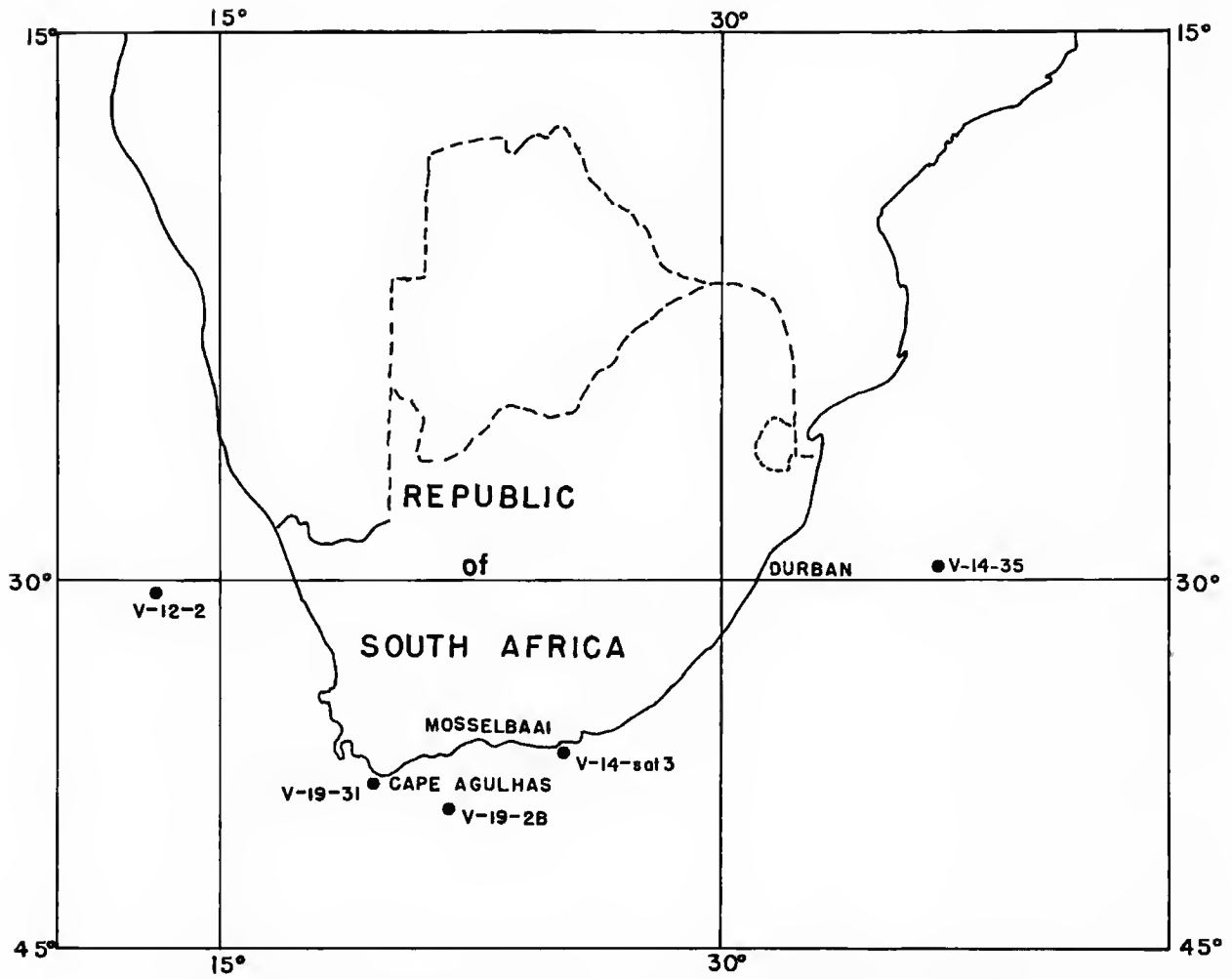


FIGURE 4.—South Africa, showing brachiopod localities of the *Vema*.

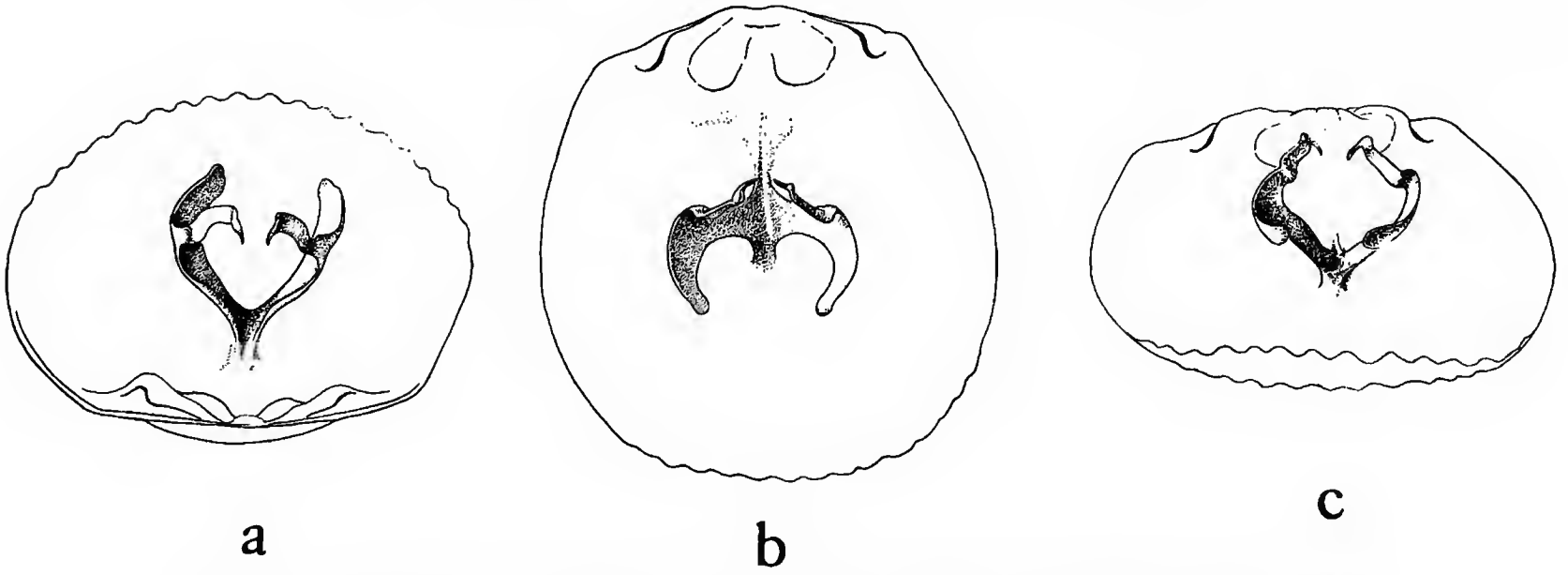


FIGURE 5.—Posterior, ventral, and anterior views of the dorsal valve of *Kraussina rubra* (Pallas), showing loop with its prongs, × 2. [Drawn by Mr. Lawrence B. Isham, Visual Information Specialist, Smithsonian Institution. Hypotype: USNM 550547c.]

Vema Brachiopod Localities

Theta–1–6. Latitude 31°41–43'N, longitude 68°08'W, at 5159 meters, southwest of Bermuda.

Genus and species indeterminate=immature terebratulacean

Pelagodiscus atlanticus (King)

V–12–2. Latitude 30°14.9'S, longitude 13°03'E, at 3045 meters, off the west coast of South Africa.

Cryptopora boettgeri Helmcke

V–12–13. Latitude 4°23.9'S, longitude 0°18'W, at 4167 meters, west of Gabon, Africa.

Pelagodiscus atlanticus (King)

V–14–2. Latitude 41°49'S, longitude 64°20'W, at 129 meters, in Gulf of San Matias, Argentina.

Magellania venosa (Solander)

Aneboconcha obscura, new species
V–14–5. Latitude 45°51'S, 61°52'W, at 107 meters, off the Gulf of San Jorge, Argentina.
Magellania venosa (Solander)
V–14–9. Latitude 51°29'S, longitude 66°42'W, at 105 meters, off Bahia Grande, Argentina.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander) young.
V–14–14. Latitude 54°23'S, longitude 65°35'W, at 75 meters, north of Cabo San Diego, Tierra del Fuego, Argentina.
Liothyrella oblonga, new species
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
V–14–15. Latitude 52°56'S, longitude 66°49'W, at 86 meters, just south of the east mouth of the Strait of Magellan, Argentina.
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)
V–14–19. Latitude 52°41'S, longitude 59°09'W, at 108 meters, south of East Falkland Island.
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)
V–14–35. Latitude 29°44'S, longitude 37°15'E, at 5013 meters, east of Durban, South Africa.
Pelagadiscus atlanticus (King)
V–14–Sat3. Latitude 34°15'S, longitude 25°06.5'E, at 114 meters, off Cape St. Francis, South Africa.
Kraussina rubra (Pallas)
Mergerlina natalensis (Krauss)
V–15–5. Latitude 20°30'N, 73°16'W, at 4798 meters, off the northwest coast of Haiti, Caribbean.
Chlidonophora incerta (Davidson)
V–15–6. Latitude 19°26'N, longitude 75°09'W, at 3885–4080 meters, off the southeast side of Cuba, Caribbean.
Chlidonophora incerta (Davidson)
V–15–10. Latitude 14°05'N, longitude 75°25'W, at 4077 meters, southeast of Jamaica, in Columbian Basin, Caribbean.
Chlidonophora incerta (Davidson)
V–15–11. Same as above, at 4283 meters.
Chlidonophora incerta (Davidson)
V–15–12. Latitude 11°30'N, longitude 75°50'W, at 2868–2875 meters, off the north coast of Colombia, Caribbean.
Chlidonophora incerta (Davidson)
V–15–13. Same as above, at 2875–2944 meters.
Chlidonophora incerta (Davidson)
V–15–14. Latitude 10°11'N, longitude 78°30'W, at 1826 meters, north of east end Panama, Caribbean.
Pelagodiscus atlanticus (King)
V–15–18. Latitude 10°13'N, longitude 78°33'W, at 1703–1905 meters, off the north coast of Panama, Caribbean.
Chlidonophora incerta (Davidson)
V–15–22. Latitude 09°46.3'N, longitude 79°37.5'W, at 974 meters, off the north coast of Panama, Caribbean.
Crytopora gnomon (Jeffreys)
V–15–25. Latitude 09°43.5'N, longitude 79°39'W, 305–340 meters, off Colon, on north side of Panama, Caribbean.
Terebratulina cailleti Crosse
Dallithyris? species
V–15–38. Latitude 05°00'N, longitude 79°04'W, at 3023–3250 meters, off the west coast of Colombia.
Macadrevia aff. *M. diamantina* Dall
V–15–46. Latitude 09°22'N, longitude 89°33'W, at 3517–3528 meters, West of Costa Rica.
Pelagodiscus atlanticus (King)
V–15–60. Latitude 06°21'N, longitude 85°17'W, at 1892 meters, northeast Cocos Island, Costa Rica.
Pelagodiscus atlanticus (King)
V–15–61. Latitude 04°15'N, longitude 85°06'W, at 3254–3260 meters, off the west coast of Colombia.
Macandrevia aff. M. diamantina Dall
V–15–80. Latitude 12°57.5'S, longitude 85°38'W, at 4483–4513 meters, off Peru.
Neorhynchia strebeli (Dall)
V–15–93. Latitude 50°17'S, longitude 66°50'W, at 82 meters, off southeast of San Julian, Argentina.
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin), small, coarse ribbed
Magellania venosa (Solander)
V–15–98. Latitude 54°24'S, longitune 63°29'W, at 198 meters, west side Burdwood Bank.
Liothyrella oblonga, new species
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
Aneboconcha obscura, new species
V–15–99. Latitude 54°07.8'S, longitude 63°54'W, at 119 meters, west side Burdwood Bank.
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
V–15–100. Latitude 53°08'S, longitude 65°07.5'W, at 126 meters, southwest of West Falkland Island.
Liothyrella uva (Broderip)
V–15–102. Latitude 52°53.3'S, longitude 65°35'W, at 108 meters, east of east end of Strait of Magellan, south-southwest of West Falkland Island.
Liothyrella uva (Broderip)
Magellania venosa (Solander)
V–15–105. Latitude 54°06.6'S, 66°20'W, at 55 meters, off east coast of Tierra del Fuego, Argentina.
Liothyrella uva (Broderip)
V–15–106. Latitude 54°10.2'S, longitude 65°44'W, at 79 meters, off east coast of Tierra del Fuego.
Liothyrella uva (Broderip) [young]
Terebratella dorsata (Gmelin)
V–15–107. Latitude 54°10.2'S, longitude 65°57.5'W, at 101 meters, off east coast of Tierra del Fuego.
Liothyrella uva (Broderip) [immature]
Terebratella dorsata (Gmelin) [immature]
V–15–108. Latitude 54°10'S, longitude 64°19'W, at 110 meters, off west end of Burdwood Bank.
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
V–15–109. Latitude 54°11.5'S, longitude 62°36'W, at 403 meters, off west end Burdwood Bank.
Liothyrella uva (Broderip) [immature]
V–15–110. Latitude 54°10'S, longitude 63°20.2'W, at 284

meters, off west end of Burdwood Bank.
Liothyrella uva (Broderip) [young]

V–15–112. Latitude 56°40'S, longitude 67°26'W, at 134 meters, off the southeast end of South America.
Liothyrella uva (Broderip)
Terebratella dorsata (Gmelin)
Aneboconcha obscura, new species

V–15–124. Latitude 49°35'S, longitude 48°04.6'W, at 2740 meters, northeast of the Falkland Islands.
Cryptopora gnomon (Jeffreys)

V–15–126. Latitude 47°57.5'S, longitude 48°03'W, at 6179 meters, south side of Argentine Basin, South Atlantic.
Abyssothyris species

V–15–138. Latitude 08°27'S, longitude 34°41'W, at 84–137 meters, off Cabedelo, Brazil.
Terebratulina latifrons Dall
Argyrotheca thurmanni, new species

V–15–155. Latitude 25°28'N, longitude 77°15'W, at 3731 meters, north of Bahama Islands.
Eucalathis? species

V–15–PD3. Latitude 54°11.5'S, longitude 62°36'W, at 399 meters, west end of Burdwood Bank, Argentina.
Liothyrella uva (Broderip)

V–16–31. Latitude 36°57'S, longitude 137°33'E, at 214–269 meters, entrance to Bass Strait, south of Cape Otway, Australia.
Magellania? species 1

V–16–37. Latitude 51°52'S, longitude 67°01'W, at 101 meters, east of Rio Gallego, southern Argentina.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–16–39. Latitude 50°53'S, longitude 62°35'W, at 157 meters, northwest of West Falkland Island.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–16–40. Latitude 42°48'S, longitude 63°11'W, at 70 meters, off Valdes Peninsula, Argentina.
Magellania species 2

V–16–42. Latitude 46°38'N, longitude 55°07'W, at 148 meters, on the south side of Newfoundland.
Hemithiris psittacea (Gmelin)

V–16–44. Latitude 48°54'N, longitude 51°08'W, at 315 meters, off east side of Newfoundland.
Terebratulina septentrionalis (Couthouy)

V–16–48. Latitude 60°10'N, longitude 47°08'W at 300 meters, off the south tip of Greenland.
Terebratulina septentrionalis (Couthouy)
Macandrevia cranium (Müller)
M. tenera (Jeffreys)

V–16–49. Latitude 60°10'N, longitude 47°10'W, at 274 meters, off the south tip of Greenland.
Macandrevia cranium (Müller)

V–16–52. Latitude 55°37'N, longitude 56°08'W, at 2078 meters, off the Labrador Coast.
Cryptopora gnomon (Jeffreys)
Hemithiris psittacea (Gmelin)

V–16–54. Latitude 55°13'N, longitude 57°00'W, at 207 meters, east of Hopedale, Labrador.
Hemithiris psittacea (Gmelin)
Macandrevia tenera (Jeffreys)

V–16–55. Latitude 55°48'N, longitude 56°00'W, at 2452 meters, east of Hopedale, Labrador.
Macandrevia tenera (Jeffreys)

V–17–1. Latitude 07°10'S, longitude 85°50'W, at 4124 meters, off coast of northern Peru.
Neorhynchia strebeli (Dall)

V–17–12. Latitude 43°30'S, 74°55'W, at 112 meters, off south end of Isla Chiloe, Chile.
Crania patagonica Dall?
Macandrevia americana (Dall)

V–17–14. Latitude 47°01'S, longitude 75°44'W, at 1201–1146 meters, off Peninsula Taitao, Gulf of Penas, Chile.
Liothyrella uva (Broderip)?

V–17–RD14. Latitude 38°58'S, 55°17'W, at 595–642 meters, southeast of Mar del Plata, Argentina.
Eucalathis inflata, new species
Dyscolia ewingi, new species
Liothyrella uva (Broderip)
Platidia davidsoni (Deslongchamps)
Genus and species undetermined

V–17–18. Latitude 53°55.5'S, 71°16.8'W, at 248–262 meters, in the Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)

V–17–19. Latitude 52°58.6'S, 70°30.8'W, at 90 meters, in the Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–17–20. Latitude 53°21'S, longitude 70°36'W, at 247 meters, in the Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander) [young?]

V–17–24. Latitude 53°37.7'S, 69°54.6'W, at 42 meters, in the Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)

V–17–25. Latitude 53°20.5'S, longitude 69°32.8'W, at 44 meters, in the Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)

V–17–27. Latitude 53°33.8'S, longitude 70°17.5'W, at 263 meters, near center Strait of Magellan, Chile.
Terebratella dorsata (Gmelin) [young]

V–17–29. Latitude 52°43.7'S, longitude 69°53.7'W, at 24 meters, east side Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)

V–17–RD29. Latitude 60°27'N, longitude 48°31'W, at 326–366 meters, west of the south tip of Greenland.
Terebratulina septentrionalis (Couthouy)
Macandrevia cranium (Müller)

V–17–30. Latitude 52°40.2'S, 69°51.5'W, at 24 meters, east end Strait of Magellan, Chile.
Magellania venosa (Solander)
Terebratella dorsata (Gmelin)

V–17–32. Latitude 52°42.3'S, longitude 69°44.5'W, at 48–55 meters, east end Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–17–33. Latitude 52°49'S, longitude 67°35'W, at 66 meters, off Cabo Virgenes, Chile.
Terebratella dorsata (Gmelin)

Magellania venosa (Solander)

V–17–36. Latitude 52°22'S, longitude 69°19.5'W, at 44 meters, off east mouth of Strait of Magellan, Chile.
Terebratella dorsata (Gmelin)

V–17–38. Latitude 53°35.4'S, longitude 70°23.5'W, at 132 meters, Strait of Magellan, Chile.
Crania species = *C. patagonica* Dall?
Terebratella dorsata (Gmelin)

V–17–47. Latitude 55°07.2'S, longitude 66°29.3'W, at 71 meters, off the southeast tip of Tierra del Fuego, Argentina.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–17–51. Latitude 55°17.5'S, longitude 66°00'W, at 205–207 meters, off the southeast end of Tierra del Fuego, Argentina.
Liothyrella uva (Broderip)
Aneboconcha obscura, new species
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–17–52. Latitude 55°20'S, longitude 65°52'W, at 938–947 meters, off the southeast tip of Tierra del Fuego, Argentina.
Liothyrella uva (Broderip)
Aneboconcha obscura, new species

V–17–53. Latitude 55°20'S, longitude 65°50'W, at 1185–1240 meters, off the southeast tip of Tierra del Fuego, Argentina.
Magellania venosa (Solander) [young]

V–17–54. Latitude 55°19'S, longitude 65°49'W, at 1274–1362 meters, off southeast tip of Tierra del Fuego, Argentina.
Magellania venosa (Solander) [young]

V–17–61. Latitude 54°44'S, longitude 55°39'W, at 1814–1919 meters, off east end of Burdwood Bank, east of south end of Argentina.
Liothyrella ? vema, new species

V–17–62. Latitude 54°41'S, longitude 55°35'W, at 1165–1199 meters, east of Gulf of San Matias, Argentina.
Indeterminate trebratulid suggesting *Dyscolia*

V–17–77. Latitude 42°51'S, longitude 58°45'W, at 95 meters, off Gulf of San Matias, Argentina.
Terebratella dorsata (Gmelin)

V–17–87. Latitude 45°21'S, longitude 60°27'W, at 110 meters, off Cabo Raso near Camarones, Argentina.
Terebratella dorsata (Gmelin)

V–17–89. Latitude 45°02'S, longitude 61°18'W, at 102 meters, off Cabo Raso, near Camarones, Argentina.
Magellania venosa (Solander)

V–17–99. Latitude 44°25'S, longitude 59°54'W, at 150–154 meters, off Cabo Raso, near Camarones, Argentina.
Terebratella dorsata (Gmelin)

V–17–100. Latitude 44°23'S, longitude 59°53'W, at 166–177 meters, near Cabo Raso, near Camarones, Argentina.
Terebratella dorsata (Gmelin)

V–18–12. Latitude 47°09'S, longitude 60°38'W, at 424–428 meters, east-northeast of Puerto Deseado, Argentina.
Liothyrella uva (Broderip)

V–18–13. Latitude 47°10'S, longitude 61°02'W, at 135 meters, east-northeast of Puerto Deseado, Argentina.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–18–15. Latitude 47°22'S, longitude 62°06'W, at 135–137 meters, northeast of Puerto Deseado, Argentina.
Terebratella dorsata (Gmelin)

V–18–16. Latitude 47°30'S, longitude 62°39'W, at 123 meters, northeast of Puerto Deseado, Argentina.
Aneboconcha obscura, new species [young]

V–18–18. Latitude 47°55'S, longitude 63°41'W, at 108 meters, east of Puerto Deseado, Argentina.
Terebratella dorsata (Gmelin)
Magellania venosa (Solander)

V–18–23. Latitude 52°25'S, longitude 68°11'W, at 22 meters, near east end Strait of Magellan, Argentina.
Magellania venosa (Solander)

V–18–26. Latitude 52°37'.5'S, longitude 74°49.5'W, at 562 meters, west entrance to the Strait of Magellan, Chile.
Magellania venosa (Solander) [young]

V–18–27. Latitude 52°41'S, longitude 75°21'W, at 470–562 meters, northwest of west entrance to Strait of Magellan, Chile.
Macandrevia americana Dall
Aneboconcha obscura, new species

V–18–32. Latitude 63°46.5'S, longitude 66°07'W, at 672–726 meters, southwest of the South Shetland Islands.
Aneboconcha obscura, new species

V–18–107. Latitude 39°05'S, longitude 144°09'E, at 77 meters, Bass Strait, off Melbourne, Australia.
Magadina cumingi (Davidson)

V–19–28. Latitude 35°40'S, longitude 21°59'E, at 165 meters, Agulhas Bank, south of Mosselbaai, South Africa.
Terebratulina cf. *T. abyssicola* (Adams and Reeve)
Agulhasia davidsoni King
Gryphid
Platidia anomioides (Scacchi and Philippi)
Kraussina rubra (Pallas)
Mergerlina striata Jackson

V–19–31. Latitude 34°56'S, longitude 19°42'E, at 82 meters, Agulhas Bank, off Cape Agulhas, South Africa.
Terebratulina abyssicola (Anams and Reeve)
Agulhasia davidsoni King
Gryphid
Platidia anomioides (Scacchi and Philippi)
Kraussina crassicosta Jackson
K. rubra (Pallas)
Megerlina striata Jackson

Y–2–8. Latitude 64°52'S, longitude 65°47'W, at 218 meters, southwest of the South Shetland Islands.
Crania patagonica (Dall)

Y–2–11. Latitude 63°40'S, longitude 64°08'W, at 240 meters, southwest of the South Shetland Islands.
Aneboconcha obscura, new species

Class INARTICULATA Huxley, 1869

Order ACROTRETIDA Kuhn, 1949

Suborder ACROTRETIDINA Kuhn, 1949

Superfamily DISCINACEA Gray, 1840

Family DISCINIDAE Gray, 1840

Subfamily DISCINISCINAE Schuchert and LeVene, 1929

Genus *Pelagodiscus* Dall, 1908

Pelagodiscus atlanticus (W. King)

PLATE 5: FIGURE 36

Discina atlantica King, 1868:170.

Pelagodiscus atlanticus (King) Helmcke, 1940:230 [for extensive synonymy].—Thomson, 1927:130.—Hertlein and Grant, 1944:21.

This is the most widespread brachiopod known, as it occurs in deep water in the Atlantic, Pacific, and Indian oceans. It is known from both northern and southern hemispheres. It was found at four localities by the *Vema*, thus corroborating its wide distribution. Each locality is in a different ocean or sea: one each from the Pacific, Indian, and Atlantic oceans and one from the Caribbean Sea. Not only is this species widespread, but it also has the distinction of occurring in very deep water, 6160 meters (Zezina 1970:5). It has also been taken at 200 fathoms (=366 meters) (Thomson 1927: 131).

LOCALITIES.—T–1–6, V–12–13, V–14–35, V–15–14, V–15–46, V–15–60.

TYPES.—Figured hypotype: USNM 550581.

Suborder CRANIIDINA Waagen, 1885

Superfamily CRANIACEA Menke, 1828

Family CRANIIDAE Menke, 1828

Genus *Crania* Retzius, 1781

Crania patagonica Dall

PLATE 4: FIGURES 2–6; PLATE 7: FIGURES 1–5

Crania patagonica Dall, 1902:562; 1903:950, pl. 62: figs. 1, 3; 1920:273.—Hertlein and Grant, 1944:40, pl. 3: figs. 1, 2 [for extended synonymy].

Three specimens, one attached to a pebble and two loose, are assigned to Dall's species, although they do not conform strictly to his description. Dall separated his three specimens from all *Crania* known at the time, because the surface of the conical dorsal valve is covered by short spines. The three *Vema* specimens are not consistent as to spinosity. The larger of the two free valves (USNM 550488a, Plate 4: figure 2) has a conspicuous patch of spines on its anterior slope. The second free specimen (USNM 550482c) is so covered by bryozans that only a small amount of the external surface is visible. Occasional pits near the margin suggest the presence of spines shorn by erosion. The third and attached specimen shows no trace of spines and it is fairly strongly lamellose. It is possible that all these shells were at one time spiny, but that these minute structures have been worn off in the gravelly environment in which they lived. It is also possible that spinescence is spasmodic in the species, some specimens having it, some not. Not enough specimens are present in Dall's collection or in the *Vema* collections to clear up the point.

Other specimens are assigned to his species, which may be worn or atypical. One (USNM 550484) has a much lower cone, and the shell at first glance seems smooth, but when magnified a few scattered spines are visible on the surface (Plate 4: figure 4). Another lot (USNM 550483) contains three specimens that are light brown in color like the preceding; they seem smooth but have scattered granules that suggest worn spines. All of these cranias are therefore referred to *C. patagonica*.

MEASUREMENTS (in mm.).—USNM 550482a: length 9.0; width 9.4; height 3.0.

LOCALITIES.—V–17–12, V–17–38, Y–2–8.

TYPES. Figured hypotypes: USNM 550482a–c, 550483a, 550484, 550506.

DISCUSSION.—*Crania lecointei* Joubin is an Antartic species suggestive of *C. patagonica,* but it is shaped differently, with the apex slightly off midvalve and the surface covered by fine concentric ridges.

Class ARTICULATA Huxley, 1869

Order RHYNCHONELLIDA Kuhn, 1949

Superfamily RHYNCHONELLACEA Gray, 1848

Family CRYPTOPORIDAE Muir-Wood, 1955

Genus *Cryptopora* Jeffreys, 1869

Cryptopora boettgeri Helmcke

Cryptopora boettgeri Helmcke, 1940:286, figs. 35, 36.

A single dorsal valve from off the west coast of South Africa is referred to this species. It was taken at a depth of 3045 meters. Specimens described by Helmcke from near the Cape of Good Hope were dredged at 500 to 564 meters. *Cryptopora* is known to range from shallow coastal waters into the abyss.

LOCALITY.–V–12–2.

Cryptopora gnomon Jeffreys

PLATE 8: FIGURES 14–16

Cryptopora gnomon Jeffreys, 1869:136.
Atretia gnomon (Jeffreys) Jeffreys, 1870:421.—Davidson, 1887: 173, pl. 25: figs. 6–13.—Dall, 1920:293.
Neatretia gnomon (Jeffreys) Fischer and Oehlert, 1891:122, figs. 11*a–c*.

Two specimens of this widespread, small rhynchonellid were collected by the *Vema*. One is from north of Colon, Panama, from 975 meters; the other was taken northeast of the Falkland Islands in 2740 meters. This little species is commonly found in abyssal waters, but Dall gives its range from 650 fathoms (=1219 meters) to 2200 fathoms (=4002 meters). *Cryptopora gnomon* is best known from the North Atlantic, but I could find no reason to separate the *Vema* specimen from south latitudes as a different species.

LOCALITIES.–V–15–22, V–15–124, V–16–52.

TYPES.–Figured hypotypes: USNM 550555a–c.

Family BASILIOLIDAE Cooper, 1959

Subfamily BASILIOLINAE Cooper, 1959

Genus *Neorhynchia* Thomson, 1915

Neorhynchia strebeli (Dall)

PLATE 5: FIGURES 19–23

Hemithyris strebeli Dall, 1908:441.
Neorhynchia strebeli (Dall) Thomson, 1915:388; 1927:149.—Hertlein and Grant, 1944:57.—Cooper, 1959:34.

Two specimens of this interesting abyssal rhynchonellid were dredged off the coast of Peru. Both specimens are small, probably not fully adult, rounded pentagonal in outline, with a widely sulcate anterior commissure. The shell is transparent, a common feature of abyssal brachiopods. Both specimens are wider than long as in Dall's type. These specimens come from the general region from which Dall's specimens were taken, south and southwest of the Galapagos Islands.

Although *Neorhynchia* is a very rare genus, it enjoys a wide distribution. This species is reported in the open Pacific off the coast of mid-Chile by McCammon and Buchsbaum (1968:216), from a depth of 3600 meters. Muir-Wood (1960:524) reports it off Valparaiso, Chile, at 2160 fathoms (=3950 meters). Foster (1969) reports it off the southwest end of South America. So far it has not been reported outside of Pacific waters.

LOCALITIES.–V–15–80, V–17–1.

TYPES.–Figured hypotype: USNM 550505.

Family HEMITHYRIDIDAE Rzhonsnitzkaya, 1956

Genus *Hemithiris* D'Orbigny, 1847

Hemithiris psittacea (Gmelin)

Hemithyris psittacea (Gmelin) Dall, 1920:284.—Hertlein and Grant, 1944:47 [for extensive synonymy].

This circumpolar species was taken from off the Labrador coast and the coast of Newfoundland. One of the locations off the Labrador coast (V–16–52) furnished this species from deeper water than hitherto recorded: 2078 meters. The species is more commonly found in fairly shallow water, ranging in depth from 6 meters to 163 meters (Dall, 1920:284–286).

LOCALITIES.–V–16–42, V–16–52, V–16–54.

Order TEREBRATULIDA Waagen, 1883

Suborder TEREBRATULIDINA Waagen, 1883

Superfamily TEREBRATULACEA Gray, 1840

Family CANCELLOTHYRIDIDAE Thomson, 1926

Subfamily CANCELLOTHYRIDINAE Thomson, 1926

Genus *Terebratulina* D'Orbigny, 1847

Terebratulina abyssicola (Adams and Reeve)

PLATE 8: FIGURES 34–43

Terebratula abyssicola Adams and Reeve, 1850:72, pl. 21: fig. 5.
T. (*Terebratulina*) *abyssicola* (Adams and Reeve) Reeve, 1860: pl. 4: fig. 14.
Terebratulina caput-serpentis var. *septentrionalis* Davidson [not Couthouy] 1880:33–36.
T. abyssicola (Adams and Reeve) Davidson, 1886:37, pl. 5: fig. 54.—Dall, 1920:307.—Helmcke, 1938:239; 1940:243, figs. 8–12.—Jackson, 1952:10.
Terebratula radiata Reeve, 1860: pl. 3: figs. 7*a–b*.
Terebratulina radiata (Reeve) Davidson, 1886:34, pl. 5: figs. 9–14.
T. africana Turton, 1932:260, pl. 70: fig. 1842.

A number of dead shells not preserving any of the characteristic dark bands of this species do, however, show the characteristic anterior folding. This consists of a short sulcus on the dorsal valve, which is matched by a flattening or short sulcation on the ventral valve. In addition to the ventral flattening or sulcation, some specimens have a short, low, narrow fold at the anterior of the ventral valve. This species was described in great detail by Helmcke (1940:243). This is one of the commoner of the South African brachiopods.

LOCALITIES.—V–19–28, V–19–31.

TYPES.—Figured hypotypes: USNM 550548a, b.

Terebratulina cailleti Crosse

Terebratulina cailleti Crosse, 1865:27, pl. 1: figs. 1–3.—Dall, 1871:10.—Davidson, 1886:26, pl. 5: figs. 41, 42.—Dall, 1920: 308.

This common Caribbean species was taken at latitude 09° 43.5' N, latitude 79° 39' W, off Panama. One complete specimen and a dorsal valve are all that were found, but they are characteristic of the species in their elongate oval outline, strong posterior beaded costellae, and the abundant anterior, finer costellae. The complete specimen (USNM 550476a) measures in mm: length 10.4; dorsal valve length 8.9; maximum width 7.0; hinge width 3.3; thickness 4.2.

LOCALITY.—V–15–25.

Terebratulina latifrons Dall

PLATE 8: FIGURE 17

Terebratulina cailleti var. *latifrons* Dall, 1920:309.

A single specimen referred to this species conforms to the exterior details outlined by Dall: wider than *T. cailleti* and more or less bilobate. The specimen does not conform to the color specifications mentioned by Dall. It is completely white and does not have the interior salmon tint mentioned by Dall. The specimen was dead and empty and may have been bleached of any color it may have had. One of the distinctive features of this species is its narrow, deep sulcus on the ventral valve. The dorsal valve is correspondingly subcarinate. These two characters lead to an indented anterior margin and thence to the bilobate character mentioned.

Subcarinate terebratulinas similar to this one occurred in the Miocene of the Caribbean region. This type of exterior is uncommon, and it is interesting to see this ancient type living at the present time. This is the farthest south that this species has been seen.

LOCALITY.—V–15–138.

TYPES.—Figured hypotype: USNM 550554.

Terebratulina septentrionalis (Couthouy)

Terebratula septentrionalis Couthouy, 1838:65, pl. 3: fig. 18.
Terebratulina septentrionalis (Couthouy) Dall, 1920:297 [for additional synonymy].

Three lots of this common species were taken from southwest of the south tip of Greenland. The specimens are about medium size for the species, the largest measuring 18 mm long by 14.5 mm wide.

LOCALITIES.—V–16–44, V–16–48, V–17–RD29.

Subfamily CHLIDONOPHORINAE Muir-Wood, 1959

Genus *Chlidonophora* Dall, 1903

Chlidonophora incerta (Davidson)

PLATE 4: FIGURES 7, 8; PLATE 5: FIGURES 24–31

Megerlia? incerta Davidson, 1878:438; 1880:49, pl. 2: figs. 17, 18.
Terebratulina incerta Davidson, 1886:38, pl. 6: fig. 23–25.
Chlidonophora incerta (Davidson) Dall, 1903:1538; 1920:322.—Thomson, 1927:181.—Cooper, 1954:364.

This little deepwater species was taken at six localities in the Caribbean. It is usually subcircular in outline, with a fairly wide hinge and short beak, with large open foramen. In its outline and profile it is strongly reminiscent of the dalmanellids of the

Ordovician. The exterior is multicostellate and the shell strongly punctate. Inside, the ventral valve has thick, wide teeth but no dental plates. The muscle field is small and located just anterior to the delthyrial cavity.

The cardinalia of the dorsal valve are very similar to those of *Terebratulina* except for the loop, which is quite different. As in *Terebratulina,* the socket ridges are broad and fairly high, with their posterolateral extremities protruding posterior to the hinge line. The cardinal process is not well developed in the specimens taken by the *Vema,* merely a wide central pit located at the middle of the cardinalia. The crura or descending elements of the loop are short, extending obliquely toward midvalve in anteromedial direction, round in cross section. These bear the crural processes that are concave inward and sharply pointed with the points directed medially. The anterior part of the loop is flat ribboned, anteriorly narrowly rounded to bluntly pointed and directed ventrally and slightly anteriorly. The crural processes do not grow medially to meet as they do in *Terebratulina,* and the anterior transverse ribbon of the loop is more protuberant beyond the crural processes than in *Terebratulina.*

Perhaps the most interesting feature of this species is its pedicle, which is unlike that of any other genus in the extent to which it frays at the anterior end. The pedicle of the specimens collected by the *Vema* is a variable structure. In most of the specimens, immediately on emergence through the foramen it is frayed into numerous strands that radiate from the foramen through 360° and attach to any solid object encountered. In specimen USNM 550464 the strands have attached themselves to numerous fairly large Foraminifera. This habit is characteristic also of *Chlidonophora chuni* (Blochmann) from the Indian Ocean. In that species, however, the pedicle usually frays some distance from the beak and is much longer than any pedicle seen in *C. incerta.* In another large *Vema* specimen (USNM 550463), the pedicle is extended fully 2 mm beyond the foramen before it is frayed. In this example the strands are attached to the dead ventral valve of another specimen of *Chlidonophora.* The lophophore of *Chlidonophora* is described by Muir-Wood (1959:297) as subplectolophous. This has two side arms, but the median coil of the loop is incipient.

Chlidonophora has an odd distribution as it is now known. It was first dredged by the *Challenger* northeast of the Island of Fernando de Noronha, Brazil, at 1850 fathoms (=3384 meters). It is also known in the Caribbean and the Gulf of Mexico, in depths ranging from 292 fathoms (=534 meters) and 2100 fathoms (=3841 meters). Another species, *C. chuni* (Blochmann), occurs in the Indian Ocean, off the Maldives, in depths of 1829–2051 meters (Muir-Wood, 1959:297). The genus has been said to be present in the Cretaceous (Williams, 1965: H810), but I have never seen a Cretaceous species that I would assign to it. Most of the small rotund terebratulinoids of the Cretaceous either belong to the new genus *Cruralina* Smirnova (1966) or have the characteristic ringed loop of *Terebratulina.* Muir-Wood in the same reference also states that it occurs in the Eocene of North America but it is not listed there by Stenzel (1943), who prepared a card catalog of Eocene brachiopods. To date it has not appeared in any of the Tertiary deposits in the Caribbean area, although it might be expected there. However, if *Chlidonophora* throughout its life span was consistently an abyssal species, the likelihood of finding it as a fossil is rather remote.

LOCALITIES.—V–15–5, V–15–6, V–15–10, V–15–11, V–15–12, V–15–13, and V–15–18.

TYPES.—Figured hypotypes: USNM 550462c, 550463a,b, 550464.

Subfamily EUCALATHINAE Muir-Wood, 1965

Genus *Eucalathis* Fischer and Oehlert, 1890

Eucalathis inflata, new species

PLATE 4: FIGURES 11–13; PLATE 7: FIGURES 13–20

Large for the genus, triangular in outline, widest anterior to midvalve; sides nearly straight; anterior margin broadly rounded; apical angle 80° to 90°. Anterior commissure rectimarginate. Interareas narrow; foramen large, open, with a slight development of deltidial plates. Apical plate thick and long. Surface multicostellate, with the costellae appearing in three generations. Costellae broadly subangular, about 20–22 along the margin; concentric growth lines only moderately developed. Generations of costellae appearing about 2 and 4

mm anterior to the dorsal beak. Pedicle long (3.5 mm) and frayed. Setae short.

Ventral valve evenly and gently convex in lateral profile, broadly and gently domed in anterior profile; beak narrowed, with a narrow sulcus extending for about one-third the valve length, where three costallae are intercalated and the sulcus loses its identity in the general convexity of the valve; anterior flattened; sides short, curved, and steep.

Dorsal valve flatly convex in lateral profile except for the umbonal region which is narrowly curved; anterior profile strongly domed, somewhat narrowly in the median region and with long, steep lateral slopes; umbonal region swollen, with a slight depression occupied by a single costella corresponding to the sulcus of the opposite valve, sulcus disappearing at midvalve, where it inverts to a low, poorly defined fold. Lateral and anterior slopes steep.

Ventral valve interior with thick teeth but no dental plates. Dorsal valve with short, but strong, socket ridges bearing flat, ribbon-like crura; crural processes exceptionally broad and flat, strongly curved, and bluntly pointed. Anterior of loop sharply pointed and with a long, curved, broad ribboned distal end.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Maximum width*	*Hinge width*	*Thickness*	*Apical angle*
550479a	6.5	5.4	5.9	2.3	3.4	88°
550479b	6.5	5.5	5.4	1.6	3.3	80°
550479c	6.0	5.0	5.1	1.2	3.1	81°

LOCALITY.—V–17–RD14.

DIAGNOSIS.—Large *Eucalathis* with swollen dorsal valve and narrow, massive loop.

TYPES.—Holotype: USNM 550479a. Figured paratype: USNM 550479b.

COMPARISON AND DISCUSSION.—This species need be compared only to *Eucalathis* of comparable size: *E. murrayi* (Davidson), and *E. ergastica*. From the former it differs in having a finer ornament, a more swollen dorsal valve, and a narrower, stouter loop. It differs from *E. ergastica* in the same characters: in having a similar costellation but less imbricate or beaded microornament, in having a differently shaped and more swollen dorsal valve, and in having a narrower and stouter loop.

Like many other brachiopod genera, *Eucalathis* has no consistent depth range. It has been dredged from 365 meters down to 2561 meters.

Eucalathis? species

PLATE 4: FIGURES 14–17

Minute, elongate triangular in outline; sides diverging anteriorly and merging into the strongly rounded anterior margin; valves unequal in depth, the ventral valve having the greater depth and a gently convex lateral profile, but a narrowly domed anterior profile; dorsal valve gently convex in lateral profile, with the most convexity just posterior of midvalve and with its anterior profile forming a low dome, with narrowly convex median region. Anterior commissure rectimarginate. Surface marked by six broad costae. Ventral valve with narrow, flat interareas bounding a broad, thick, convex symphytium, from the posterior of which emerges a fairly large, round foramen, mesothyridid in position. Pedicle moderately long and thin. Teeth large and thick.

Dorsal valve interior terebratulinid in its cardinalia, with strong socket ridges bulging posteriorly to the posterior margin; cardinal process small; crura wide with broad, blunt crural processes; transverse ribbon either broken or not formed, represented by two thin anterodorsad points, suggesting a narrow, delicate, probably dorsad-facing, transverse ribbon. Lophopore a small spirtolophe like that of *Eucalathis*. Coarsely punctate.

MEASUREMENTS (in mm).—USNM 550508: length 2.4, dorsal valve length 1.9, width 1.9, thickness about 1.0, apical angle 66°.

LOCALITY.—V–15–155.

TYPES.—Figured specimen: USNM 550508.

DISCUSSION.—The anomalous beak region and the uncertainty regarding the loop of this tiny, interesting shell makes generic assignment difficult. The large symphytium may be an atavistic development

because no other modern cancellothyridid like it is known. On the other hand it may represent an unrecorded trend in modern brachiopods. *Cancellothyris* has a symphytium which is its only claim to generic status, but the symphytium is entirely unlike that of the little shell under discussion. The character of the punctation and tentative nature of the ornament suggest that this specimen is a young one, but the character of the beak seems like a permanent feature because of its thickness. Additional specimens are needed to establish the true position of this anomalous shell among the Cancellothyrididae.

Subfamily AGULHASIINAE Muir-Wood, 1965

Genus *Agulhasia* W. King, 1871

Agulhasia davidsoni W. King

PLATE 8: FIGURES 18–24

Agulhasia davidsoni W. King, 1871:109, pl. 11: figs. 1–1.—Sowerley, 1897:28.—Thomson, 1927:182, fig. 52.—Helmcke, 1938:234; 1939:217, 226, 234, 235, fig. 7; 1940:242, fig. 7.—Jackson 1952:9.

Terebratulina (*Agulhasia*) *davidsoni* (King) Davidson, 1886: 36, pl. 7: figs. 1–5.—Oehlert, 1887:1249, 1315.

All the specimens of this unique brachiopod collected by the *Vema* were dead and none of them preserved the loop. Inasmuch as the loop was incorrectly drawn by King, a specimen from the Agulhas Bank, South Africa, is figured herein to show the true character of this structure. King's figure depicts a short, wide loop, whereas it is actually rather long and anteriorly rounded.

LOCALITY.—V–19–28, V–19–31.

TYPES.—Figured hypotypes: USNM 549456, 550551a, b.

Family TEREBRATULIDAE Gray, 1840

Subfamily TEREBRATULINAE Gray, 1840

Genus *Liothyrella* Thomson 1916

Liothyrella uva (Broderip)

PLATE 1: FIGURES 15–20; PLATE 6: FIGURES 23–29; PLATE 7: FIGURES 6–12

Terebratula uva Broderip, 1834:124, pl. 22: fig. 2.
Liothyrella uva (Broderip) Hertlein and Grant, 1944:98, pl. 7: figs. 8–11 [for extended annotated synonymy].

About medium size for the genus, variable, longitudinally oval in outline, with the maximum width at about midvalve; sides rounded; anterior margin fairly strongly rounded; posterolateral margins forming an angle of 70°–90°. Beak erect to slightly incurved; foramen variable, usually about medium in size, truncating the beak and slightly to moderately labiate. Symphytium solid, smooth, visible. Anterior commissure rectimarginate usually, but with a slight dorsad wave in some specimens. Color white, shell thin to moderately thick, translucent in some specimens. Surface giving the appearance of being smooth, but usually marked by incremental growth lines or varices and occasional very fine, usually indistinct, and inconspicuous radial lines. Finely and densely punctate, 138–169 punctae per square millimeter.

Ventral valve moderately convex in lateral profile, with the maximum rounding in the umbonal region; anterior profile a low, rounded dome. Beak region narrow and strongly swollen, the swelling dying out anteriorly; anterior slope usually flattened, but gently convex in some specimens.

Dorsal valve slightly shallower than the ventral valve, but with a stronger anterior profile which is somewhat narrowly domed and with fairly long, lateral slopes. Umbonal region narrowly swollen, the swelling extending prominently to midvalve but flattening anteriorly; anterior slope gently convex to flattened.

Ventral valve interior without dental plates and with small teeth. Genital areas large. Dorsal valve with rather thin socket ridges. Loop equal in length to not quite a third the valve length; outer hinge plates narrow, deeply concave; crural bases forming an elevated border to the outer hinge plates and forming inwardly curved, broad, elongated, and sharply pointed crural processes. Crural process located far forward on the loop; anterior of loop wide, slightly less in width than one-third the valve width. Transverse ribbon moderately broad and gently waved in a ventrad direction at its middle. Lophophore a plectolophe with long lateral branches.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Maximum width*	*Thickness*	*Apical angle*
550493	25.8	22.3	19.4	13.6	74°
550489	23.3	19.8	19.0	12.0	74°
550492a	20.9	17.7	17.6	11.0	78°
550492b	22.4	19.3	17.8	12.2	78°
550490	21.5	18.7	17.7	11.0	82°
550495	23.0	20.0	19.5	12.0	81°
550494a	19.6	16.9	15.9	10.0	82°
550494b	19.8	16.9	16.6	9.3	82°
550491	27.9	24.6	22.6	14.6	83°
550496	18.2	15.5	15.8	9.5	78°
550500	16.2	14.0	13.3	7.7	82°
550501	18.0	15.6	13.8	9.1	74°

LOCALITIES.—V–14–14, V–14–15, V–14–19, V–15–93, V–15–98, V–15–99, V–15–100, V–15–102, V–16–106 (young), V–15–107 (young), V–15–108, V–15–109 (young), V–15–110 (young), V–15–112, V–15–PD3, V–17–RD14, V–17–14, V–17–51, V–17–52, V–18–12.

TYPES.—Figured hypotypes: USNM 550491, 550492a, b, 550493.

DIAGNOSIS.—Generally small, moderately rounded *Liothyrella,* with short beak and medium-sized foramen.

COMPARISON.—The species is sufficiently like *L. moseleyi* to have led Fischer and Oehlert (1892) to its misidentification. It differs from that species in being more elongate and in having a less robust and wider loop than the Kerguelen species. It is a much smaller shell, with wider loop than *L. blochmanni* (Jackson), which occurs in Antarctica off Coats Land at a depth of 1410 fathoms (=2580 meters). *Liothyrella antarctica* (Blochmann) is a smaller and more delicate, more nearly transparent shell than the *L. uva* described here. Jackson's species *Liothyrina uva notorcadensis* is a very large, thick-shelled, and robust form that cannot be mistaken for *L. uva* as described here. *Liothyrina winteri* Blochmann is smaller, transparent, and with a less deep brachial valve than the South American species.

This species ranges through a considerable depth of water, from 55 to 642 meters. This lends strength to Blochmann's (1912:5) argument that depth and bottom conditions are irrelevant in connection with separation of species of *Liothyrella.* The *Vema* specimens range geographically from off the coast of Chile and possibly Ecuador (Dall, 1920:318) through the Strait of Magellan and up the east coast of Argentina as far north as Mar del Plata. It also occurs around the Falkland Islands.

DISCUSSION.—Blochmann (1908:615) regards Broderip's type specimen as abnormal and states that the normal representation of the species is shown by the specimens figured by Fischer and Oehlert (1892) as *Terebratula (Liothyrina) moseleyi* (Davidson). Blochmann points out that Fischer and Oehlert's identification is wrong and that *L. moseleyi* is a rounder shell restricted to the Kerguelen Island region. This is certainly correct and since Blochmann's time, *Liothyrella uva* has been identified in this sense, and it is on this basis that the specimens figured herein were identified.

Specimens collected by the *Vema* and here referred to *L. uva* (Broderip) are variable as would be expected, with the fairly long depth range indicated. The species is greatly in need of revision, especially with reference to the holotype, which is quite unlike any of the specimens illustrated in this monograph. Dr. Merrill W. Foster of Bradley University is preparing a revision of this species. It seems best therefore at the present to recognize Blochmann's conception of *L. uva,* even though the majority of specimens assigned to the species are not in accordance with the holotype. The type lot of *L. uva* in the British Museum (Natural History) (ZB 1352–1355) includes three small specimens aside from the holotype (ZB 1352), which are like specimens from the Antarctic and off South America. It has been stated (Blochmann, 1908:615) that the holotype is a deformed specimen and that the smaller ones are normal. Although there is slight distortion of the holotype in the beak region,

it does not affect the foramen or the fact that the shell is an elongated one, and it is to the holotype that reference ultimately should be made.

Liothyrella oblonga, new species

PLATE 1: FIGURES 1–8

Elongate oval in outline, with the sides nearly parallel and the valves subequal in depth, the pedicle valve slightly the deeper. Anterior margin narrowly rounded; anterior commissure with a slight dorsal wave. Beak erect, truncated by a large, round foramen that is moderately labiate; foramen permesothyridid; symphytium solid, mostly visible. Surface marked only by concentric varices of growth. Punctae numbering 144 per square millimeter.

Ventral valve strongly convex in lateral profile, with the beak region more strongly convex than the more anterior parts; anterior profile a broad dome with short, steep lateral slopes. Umbonal and median regions swollen, but the swelling diminishing anteriorly; flanks narrowly convex and steep.

Dorsal valve fairly evenly and fairly strongly convex in lateral profile, with the umbo more incurved; anterior profile a narrowly rounded dome with steep lateral slopes. Umbonal and median regions strongly swollen, the swelling extended to the lateral regions and flanks, which bulge slightly; anterior slope convex.

Ventral valve interior with small, elongate teeth and a short, thick, elevated pedicle collar. Muscles lightly impressed. Dorsal valve interior with wide loop, about one-third the maximum width and slightly more than a third the valve length; cardinal process well developed as a flattened semicircle; socket ridges thick; outer hinge plates narrow, concave bordered by the elevated crural base; crural processes broad and blunt, located at about two-thirds the loop length; anterolateral extremities of loop narrowly rounded, not extended; transverse ribbon only moderately broad, narrowed and bowed medially, the bend of the loop flattened. Median ridge very low but readily visible.

MEASUREMENTS (in mm).—Holotype: length 28.4, dorsal valve length 24.6, width 18.9, thickness 16.9, apical angle 64°.

LOCALITIES.—V–14–14, V–15–98?

TYPES.—Holotype: USNM 550498.

DIAGNOSIS.—Elongated *Liothyrella* with laterally bulging sides, subequal valves, and narrow width, with widest part anterior of the middle.

COMPARISON AND DISCUSSION.—This species is at once suggestive of the other large, elongate Liothyrellas, having a large foramen and narrow width: *L. blochmanni* (Jackson), *L. notorcadensis* (Jackson), *L. uva* (Broderip), and *L. stearnsi* (Dall and Pilsbry). It differs from *L. blochmanni* in being much narrower, having a larger foramen, and possessing a much wider loop, that of the Burdwood Bank specimen being very narrow and suggestive of *Dallithyris. Liothyrella notorcadensis* is a thick-shelled robust species, even larger than *L. oblonga,* but with the maximum width at midvalve, the ventral valve much deeper than the dorsal valve, the labiation of the beak much stronger, and the foramen larger. *Liothyrella uva* does not have the bulging flanks of *L. oblonga,* has a narrower posterior region, a larger and more strongly labiate foramen, and an even more slender outline. *Liothyrella? stearnsi* is a very large species that has the ventral valve much deeper than the dorsal one and flares anteriorly to produce a subtriangular outline.

The characters of *L. oblonga* are so distinct and unlike any of the other species from this extreme southern part of the Southern Hemisphere that it cannot be construed to be an aberration of *L. uva* or of *L. blochmanni.* It might be regarded as a subspecies of *L. notorcadensis,* but the differences mentioned above are sufficient to establish its claim to specific rank.

Liothyrella? vema, new species

PLATE 1: FIGURES 21–36

Large for the genus, widely and longitudinally oval in outline, with well-rounded sides, and broadly rounded anterior margin; posterolateral margins forming an angle of about 80°. Valves nearly equal in depth, with the ventral valves slightly deeper. Lateral commissure slightly curved; anterior commissure broadly but gently uniplicate. Beak strongly truncated, foramen large, slightly labiate; foramen mesothyridid; symphytium solid, concave and visible. Surface smooth, except for incremental, fine lamellae of growth. Puncta small and densely arranged, numbering 77–105 per square millimeter.

Ventral valve moderately and evenly convex in lateral profile, with the maximum convexity at about midvalve; anterior profile evenly and broadly convex, with moderately long, steep sides. Umbonal and median regions swollen, but after midvalve the shell becoming flattened to form a poorly defined sulcus and broad, short tongue. Anterolateral extremities slightly swollen; lateral slopes convex and steep.

Dorsal valve evenly convex in lateral profile and the maximum convexity located near midvalve; anterior profile a broad, evenly convex dome, not so strongly elevated as that of the ventral valve and having short steep sides. Umbonal region narrowed, beak extending under symphytium. Median region swollen, the swelling expanding anteriorly to form a wide, low fold, separated from the median region by low folds, which define a reentrant in the anterior commissure. Fold visible to midvalve.

Ventral valve with stout teeth and a short, elevated pedicle collar. Muscle scars deeply impressed. Dorsal valve interior with small semicircular cardinal process; socket ridges thick and elevated; outer hinge plates narrow and concave, margined by a slight elevation of the crural bases; inner hinge plates forming a slight swelling at the posterior. Outer hinge plates passing into the crural bases, with only a slight development of flattened crura. Crural processes thick and flattened, with blunt points overhanging the transverse ribbon of the loop. Anterior transverse ribbon broad and narrowly folded medially.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Maximum width*	*Thickness*	*Apical angle*
550480a	32.5	29.2	28.6	19.8	83°
550480b	33.4	29.8	26.7	21.2	76°

LOCALITY.—V–17–61.

DIAGNOSIS.—Large, nearly equivalved *Liothyrella?*, with stout loop and broadly uniplicate anterior margin.

TYPES.—Holotype: USNM 550480a. Figured paratype: USNM 550480b.

COMPARISON AND DISCUSSION.—This species with its elongate and narrow loop, which has nearly parallel sides, is most suggestive of *Liothyrella blochmanni* Jackson, but it has a broadly uniplicate anterior commissure which is not so of *L. blochmanni*. It is differently shaped, the maximum width being more posterior than that of *L. blochmanni,* thus making a rounder appearing shell. The loop is stouter and with a broader ribbon in the *Vema* specimen than in *L. blochmanni,* which is actually a smaller and less robust shell.

The ventral valve of specimen USNM 550480b is slightly pathologic, in having thick adventitious calcareous growths in the muscle region and just anterior to the delthyrial cavity. The muscle region of the dorsal valve of this specimen is also greatly thickened.

The loop of this species with its subparallel sides is atypical for *Liothyrella,* in which the sides of the loop are divergent. Revision of these short-looped brachiopods is greatly needed as they exhibit much variation in the various parts of their loops.

Genus *Dallithyris* Muir-Wood, 1959

Dallithyris? species

Fragments of a large terebratulid are referred to this genus, which is fairly common in the Caribbean. The largest fragment is a ventral valve in excess of 32 mm in length. The size agrees with that of *Dallithyris bartletti* (Dall), the largest of the brachiopods from the Caribbean region. The specimen has a lower, more spreading beak, and larger foramen than usual in *D. bartletti.* A fragment of dorsal valve exhibits hinge plates with vertical marginal rims exactly like those of *D. bartletti* or *D. cubensis* (Pourtales). None of the features exhibited by these specimens can be clearly identified as belonging to any of the described Caribbean species.

LOCALITY.—V–15–25.

TYPES.—Described and mentioned specimens: USNM 550556a-d.

Genus *Abyssothyris* Thomson, 1927

Abyssothyris species

PLATE 9: FIGURES 23–25

A small specimen measuring about 5.5 mm in length and width is referred to this genus. The loop is short and incomplete, but it preserves a strongly rounded anterolateral extremity, which is

strongly suggestive of that of *Abyssothyris*. The specimen is a young one and its anterior commissure is rectimarginate. The specimen was taken at 6179 meters (=20,867 feet), which is the deepest record for a brachiopod.

LOCALITY.—V–15–126.

TYPES.—Figured specimen: USNM 550552.

Family DYSCOLIIDAE Fischer and Oehlert, 1891

Genus *Dyscolia* Fischer and Oehlert, 1890

Dyscolia ewingi, new species

PLATE 2: FIGURES 1–26; PLATE 3: FIGURES 1–8

Large, subcircular to suboval in outline, with the sides strongly rounded and the anterior margin broadly rounded. Valves of unequal depth, the ventral valve having the greater depth. Maximum width at about midvalve. Anterior margin rectimarginate. Beak short, angle of truncation about 100°; apical angle 94° to 98°. Foramen large, with thick rim and moderately labiate; mesothyridid to permesothyridid. Surface marked by fine concentric lines and wavy to zigzag fine radial lines, a characteristic marking of the genus. Puncta minute and crowded.

Ventral valve evenly and moderately convex in lateral profile, moderately domed in anterior profile, which is more strongly convex than the lateral profile; umbonal and median regions moderately swollen, the swelling decreasing on the anterior slope, which is flattened. Posterolateral slopes very steep.

Dorsal valve moderately convex in lateral profile, with the maximum convexity posterior to midvalve; anterior profile broadly convex, the median region slightly flattened and the sides sloping moderately steeply; umbonal region gently convex; region anterior to umbo swollen, the swelling flattening at midvalve; anterior half flattened and with a gentle slope to the margin. Posterolateral margins short and steep.

Ventral valve interior with small teeth and short, elevated pedicle collar. Muscle field small, elongate oval in outline; diductor scars narrow and elongated; adductor scars elongated, posteriorly tapering inside the diductors.

Dorsal valve interior with widely triangular cardinal process best developed in an obese specimen; socket ridges low and rather thin for a large shell; outer hinge plates narrow and slightly concave, plastered onto the socket ridge; crural processess arising directly from the anterior end of the outer hinge plate, short and bluntly pointed; descending lamella of loop short, stout, with rounded anterior; transverse ribbon narrow, with a broad ventrad median wave. Adductor field large and rounded.

Mantle and body wall spicules densely matted and crowded.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Maximum width*	*Thickness*	*Apical angle*
550461a	39.4	35.0	39.9	22.7	98°
550461b	35.7	32.3	33.9	19.9	97°
550461c	36.8	32.3	32.1	26.4	94°
550461d	17.4	15.4	18.0	8.9	91°

LOCALITY.—V–17–RD14.

DIAGNOSIS.—Large subcircular to slightly oval *Dyscolia.*

TYPES.—Holotype: USNM 550461a. Figured paratypes: USNM 550461b–d.

COMPARISON AND DISCUSSION.—Four species of *Dyscolia* are described in the literature. One of these is a fossil and the other three are Recent species. Of the latter, *D. subquadrata* (Jeffreys) is a small species and not at all comparable to *D. ewingi.* The other two Recent species are large and very similar, *D. johannis-davisi* (Alcock) and *D. wyvillei.* Both are large and triangular in outline, the former species being nearly 2 inches (50 mm) long. Their outline is completely different from that of *D. ewingi,* which is subcircular. Other differences from the two Recent species mentioned are finer ornament and a squarer, stouter loop. The loop of *D. johannis-davisi* and *D. wyvillei* is very deli-

cate and much more rounded anteriorly than that of *D. ewingi*.

The discovery of *D. ewingi* extends the range of this genus considerably. *Dyscolia johannis-davisi* occurs in the Indian Ocean, and *D. wyvillei* has been taken from of the west coast of Africa and Spain. One specimen was taken from the West Indies. *Dyscolia ewingi* thus extends the range of the genus to the southern Atlantic. *Dyscolia guiscardiana* (Seguenza) is a Pliocene species, coming from Sicily, triangular in outline and smaller than the three large, modern species. Its loop is more like that of *D. wyvillei* than it is like *D. ewingi*. The genus is thus established in Mediterranean waters in the Tertiary. From the Chatham Islands on the east side of New Zealand another large brachiopod has been identified as *Liothyrella gravida* (Suess). It is elongate traingular in outline, with a large, truncated beak, with thickened rim and labiate anterior. Its exterior is adorned with the characteristic zigzag ornament of *Dyscolia*. Although its loop is not known, all of its external features are those of *Dyscolia,* including anterior thickening that produces a strongly flattened or even concave anterior margin (see Plate 2: figure 4 of *D. ewingi*). This occurrence places *Dyscolia* in Pacific waters in the Tertiary, but the genus has not yet been found in modern Pacific waters.

This species is named for Dr. Maurice Ewing, Director of the Lamont-Doherty Geological Observatory of Columbia University, who through his tireless search for knowledge, made this paper possible.

Dyscolia? species

Fragments of 5 valves of a very large terebratulid were taken at locality V–17–62. The dorsal valve suggests a transversely oval species. There are none with that shape referable to *Liothyrella*. The shells are so worn that even the hinge plates have been destroyed, and none of the fine ornament can be seen. Large size and transverse outline suggest reference to *Dyscolia*.

Superfamily TEREBRATELLACEA King, 1850

Family MEGATHYRIDIDAE Dall, 1870

Genus *Argyrotheca* Dall, 1900

Argyrotheca thurmanni, new species

PLATE 8: FIGURES 1–11

Small, wider than long, with a straight hinge line and slightly acute to obtuse cardinal extremities. Ventral valve hemipyramidal; dorsal valve flat, to gently convex in lateral profile; ventral valve interarea broad, strongly apsacline; foramen large, irregular; deltidial plates fairly large where preserved. Apical plate, when preserved, broad and thick. Surface marked by four broadly rounded and low costae on each side of shallow sulci occupying the middle of each valve; anterior commissure rectimarginate to slightly sulcate; anterior margin not serrated.

Interior of pedicle valve with thin and elevated median septum, reaching a crest just anterior to the edge of the apical plate; anterior edge of septum coarsely serrated. Septum terminating at about midvalve and extended anteriorly as a low ridge.

Dorsal valve interior with short socket ridges and broad callosity bearing the scars of the pedicle muscles; median septum thick and spatulate on its posterior face, but with a serrated anterior slope; crural process long and thin; loop a thin submarginal ribbon; space between loop and anterior callosity filled by adventitious shell in which the narrow adductor scars are sunk.

MEASUREMENTS (in mm).–

USNM specimens	*Length*	*Dorsal valve length*	*Width*	*Hinge width*	*Thickness*
550560a (holotype)	2.6	2.5	2.8	2.9	2.2
550560b	2.5	2.4	2.4	2.6	1.7

LOCALITY.–V–15–138.

DIAGNOSIS.–Small, sparsely costate *Argyrotheca,* with greatly thickened dorsal valve interior.

TYPES.–Holotype: USNM 550560a. Figured paratype: USNM 550560b.

COMPARISON.–This species need be compared only with the smaller species of *Argyrotheca* such as: *bermudana* Dall, *pera* Mühlfeldt, *woodwardiana* Davidson, *schrammi* (Crosse and Fischer) and *rubrotincta* (Dall). It is easily distinguished from *A. bermudana* and *woodwardiana* by its stronger ornament and thicker valves, the first two being nearly smooth and thin shelled. It differs from *A. pera* in its more subdued ornament and in not hav-

ing a scalloped anterior margin. It is most like *A. schrammi* and *A. rubrotincta,* but its costation is much more subdued than either of those, and it lacks the red tints and stripes of the latter.

Argyrotheca thurmanni differs from all of these species in having the interior of the dorsal valve almost completely filled with adventitious shell. An undescribed, but much larger, *Argyrotheca* from the Gulf of Mexico has its dorsal valve greatly thickened by callus.

The species is named for Mr. Gerald W. Thurmann of the American Museum of Natural History, who sorted many of the brachiopods from their samples.

Family PLATIDIIAE Thomson, 1927

Genus *Platidia* Costa, 1852

Platidia anomioides (Scacchi and Philippi)

PLATE 9: FIGURES 49–52

Orthis anomioides Scacchi and Philippi, 1844:69, pl. 18: fig. 9.
Platidia anomioides (Scacchi and Philippi) Fischer and Oehlert, 1891:92, pl. 8: figs. 14 *a-g* [also for synonymy]. Dall, 1920:332 [references to *P. seminula* should be omitted from synonymy].

Two specimens of a *Platidia* are referable to this species. One is a ventral valve and the other a complete specimen. The exterior is smooth except for a few concentric wrinkles. The complete specimen was attached to a bryozoan frond.

LOCALITY.—V–19–28, V–19–31.

TYPES.—Figured hypotypes: 550559a, b.

Platidia davidsoni (Deslongchamps)

PLATE 4: FIGURES 18–29; PLATE 5: FIGURES 37, 38

Morrisia davidsoni Deslongchamps, 1855:443, pl. 10: figs. 20*a-d*.
Terebratula (*Morrisia*) *davidsoni* (Deslongchamps) Reeve, 1861a, pl. 10: fig. 42.
Argiope (*Zellania*) *davidsoni* (Deslongchamps) Weinkauff, 1867:290.
Platidia davidsoni (Deslongchamps) Dall, 1870:143.—Fischer, 1872:160, pl. 6: figs. 3–9.—Monterosato, 1879:306.—Davidson, 1887:154, pl. 21: figs 23–27.—Fischer and Oehlert, 1891:100, pl. 8: figs. 15*a*-15*d*.—Atkins, 1959: 103–118.

Of about usual size for the genus, broadly elliptical in outline, with the width slightly greater than the length; valves concavo-convex, the ventral valve moderately convex in profile; lateral and anterior margins strongly rounded; posterior forming a broad, obtuse angle; beak small, well defined. Foramen amphithyridid, the largest opening being in the dorsal valve. Anterior commissure without folding. Surface devoid of radial, but covered by fine concentric wavy lines and some narrow, elliptical pustules.

Ventral valve evenly and moderately convex in lateral profile, broadly but somewhat narrowly domed in anterior profile, with the median region most convex and with long sloping sides. Beak narrowly swollen, the swelling continuing anteriorly as a fold, but diminishing at the anterior. Interior with short interareas and a thickened apex; sockets shallow; median ridge short and thick.

Dorsal valve concave to posteriorly gently convex, often misshapen or distorted; foramen large, triangular, and occupying almost one-third the valve length. Interior with long, narrow teeth; crura long, but with small, sharply pointed processes at about midlength of the loop; descending processes of the loop attached to septum narrow and delicate; apex of septum with two sharp prongs, the ascending elements of the loop; septum about one-third valve length, strongly elevated at the anterior. Lophophore strongly spicular.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Width*	*Thickness*
550481a	4.3	3.6	5.0	1.0
550481b	4.4	3.8	4.4	1.5
550481c	4.6	3.9	4.5	?

LOCALITY.—V–17–RD14.

DIAGNOSIS.—Subcircular to elliptical *Platidia,* with very large dorsal foramen and normally concave dorsal valve.

TYPES.—Figured hypotypes: USNM 550481a-c.

COMPARISON AND DISCUSSION.—This species has the same appearance as *P. anomioides* Scacchi and Philippi, but has a less prominent ventral beak, a larger more triangular dorsal foramen, and more delicate loop with finer, sharper crural processes. The exterior ornament is also different.

It is interesting to note that this is another Mediterranean type in southern waters, associated with two other genera that are more typically Mediterranean.

Family KRAUSSINIDAE Dall, 1870

Genus *Megerlina* Deslongchamps, 1884

Megerlina natalensis (Krauss)

PLATE 8: FIGURES 25–33

Terebratula natalensis Krauss, 1844 (plates): pl 2*b*: figs. 4–7; 1848a (text):36; 1848b:33, pl. 2: figs. 11*a-c*.
T. algoensis Sowerby, 1847:362, pl. 71: figs. 91, 92.

Large for the genus, subpentagonal to quadrate in outline, with the greatest width at about midvalve. Valves subequal in depth. Sides gently rounded; posterolateral margins forming an angle of 111° Anterior margin somewhat narrowly rounded. Anterior commissure narrowly sulcate. Surface marked by closely crowded costellae, increasing by bifurcation and intercalation, strongest posteriorly. Color white on the dorsal valve, with about 9 short red bands at the anterior; ventral valve with a reddish pink blush.

Ventral valve gently convex in lateral profile but broadly carinate in anterior profile. Median fold narrow, extending from beak to anterior margin. Lateral slopes flat.

Dorsal valve gently convex in lateral profile, with the maximum convexity in the posterior third; anterior profile broadly and gently convex and with a shallow, narrow median depression; median sulcus narrow, shallow, and extending from beak to anterior margin. Flanks gently swollen.

Ventral valve interior with small teeth, no dental plates and a short, excavated pedicle collar. Dorsal valve interior with strong socket ridges and fulcral plates defining narrow deep sockets; notothyrial cavity formed by short plates uniting with the valve floor and buttressing the socket ridges (hinge plates?); cardinal process small, elliptical in outline, without shaft. Median septum narrow, fairly high, and expanding anteriorly. Brachidium consisting of two diverging plates directed anteroventrally, each bluntly pointed distally. The free ends of the prongs bear a small hook on each side and face medially. The outside of the prong also bears a small protuberance, possibly the remnant of the descending lamellae of a loop.

MEASUREMENTS (in mm).—Length 13.4, dorsal valve length 11.6, midwidth 13.7, hinge width 9.0, thickness 5.7.

LOCALITY.—V–14–SAT3.

TYPES.—Figured hypotypes: USNM 550561a, b.

Megerlina striata Jackson

PLATE 9: FIGURES 26–48

Kraussina pisum Davidson [not Lamarck], 1880:54, pl. 4: figs. 7, 8; 1887:123, pl. 21: figs. 1–4.
Megerlina striata Jackson, 1952:28, pl. 3: figs. 6, 9.

This species is characterized by its carinate ventral valve and a dorsal valve with a narrow but deep sulcus, thus producing a strongly sulcate anterior commissure. The exterior is multicostellate and the color is generally pale yellow. Some young specimens have the anterior reddish or pale orange. This species suggests the Ordovician and Silurian genus *Dalmanella* in its external appearance.

The cardinalia consist of short socket ridges partly excavated and the socket formed by a fulcral plate. A callosity, excavate anteriorly, bears the pedicle muscles and the cardinal process. The latter is small, somewhat elliptical, and confined to the posterior margin. The median ridge is medially grooved, extends from the posterior callosity, and extends to a point slightly anterior to midvalve. At its distal end two prongs diverge ventrally and project somewhat anteriorly. The prongs are distally and narrowly rounded. Young specimens do not deviate significantly from the adults. The interior surface of the dorsal valve, especially of young specimens, is marked by conspicuous rows of coarse granules. The anterior margin of the dorsal valve interior is marked by a row of spines. A few spines also appear at the anterior of the ventral valve interior. Unfortunately most of the specimens are badly worn single valves and some of the details have been lost. This is true of the loop structure in the dorsal valve, which has lost certain small prongs from the outer sides and the posterodistal extremities.

LOCALITY.—V–19–28, V–19–31.

TYPES.—Figured hypotypes: USNM 550558a–h.

Genus *Kraussina* Davidson, 1859

Kraussina crassicosta Jackson

PLATE 9: FIGURES 1–9

Kraussina crassicosta Jackson, 1952:26.

This species is distinguished from *Kraussina rubra* (Pallas) by its smaller size, more convex valves, and generally stronger ornament. Specimens are

nearly equal in length and width and have about 12 fairly strong, angular costae, some extending directly from the posterior margin, but a few intercalated. The posterolateral extremities are marked by fine and indistinct costellae, 4 to 6 in number, but often not visible because of wear. The color is pale reddish in the one live specimen taken. The dorsal valve is faintly sulcate.

Several interiors in fairly good condition were taken, but none of them shows forked-loop structures characteristic of this genus. The ventral valve has small teeth and a very short, thickened pedicle collar that forms a narrow band on the posterior margin. The diductor scars are large and occupy the sloping inner face between the teeth and the median depression, but are separated by squarish adductor scar, bounded anteriorly by a slight curved elevation. A pallial trunk, usually not well defined, extends between the adductor and diductor scars to a point slightly beyond midvalve.

The dorsal valve has short, somewhat aborted but thick socket ridges, which define a small socket. The posterior is marked by a considerable thickening of the shell in which the scars of the pedicle muscles are deeply sunk. The adductor scars appear on each side of the thick median septum and are overhung by the callus in which the pedicle muscles are sunk. The cardinal process is variable, flattened posteriorly, with a grooved ridge anteriorly, which separates the pedicle muscle depressions. The median septum is thick but short, occupying about the middle third of the valve, just anterior to the pedicle muscle callosity. Its anterior end is expanded, but none of the specimens preserves the ventrad projecting prongs of the loop.

About 42 specimens of this species were taken, but only one of them was alive and only two had both valves joined. Of the 39 single valves, 18 were of the ventral valve, and 21 of the dorsal valve. This nearly even representation of the different valves suggests that the shells, although many are worn, had not suffered transportation over any great distance.

LOCALITY.—V–19–31.

TYPES.—Figured hypotypes: USNM 550549a–c.

Kraussina rubra (Pallas)

PLATE 9: FIGURES 10–22; FIGURE 5

Anomia rubra Pallas, 1766:182, pl. 14: figs. 2–11.
Terebratula capensis Küster [not Adams and Reeve], 1848:32, pl. 3: figs. 15–17.—Krauss [not Adams and Reeve], 1848:32, pl. 2: fig. 10
Terebratula (Kraussia) rubra.—Reeve, 1861:9, fig. 37.
Kraussina rubra.—Davidson, 1887:119, pl. 20, figs. 19–23..—Dall, 1920:374.—Jackson, 1952:22, pl. 3: figs. 1, 2.

This is a large, strikingly colored shell, readily recognized by its large foramen, irregularly truncated beak, numerous costae, flatly convex dorsal valve, and deep ventral valve. The costae are pale yellow, but the spaces between them are scarlet. The five specimens collected show considerable variation in shape, from elongate to length and width nearly equal. Abrasion of the beak is also variable, one specimen with the posterior of the ventral valve truncated, but another with a definite beak.

The interior of two specimens is exceptionally well preserved and shows the dorsal structure complete and to perfection. The grooved median septum originates anterior to the posterior callosity in which the pedicle muscles are inserted. At its distal end the septum expands and gives off an oblique fork on each side that is directed ventrolaterally. Each fork in turn branches, sending one blunt, flat process anteriorly. The second branch is a narrow ribbon that is extended ventromedially, the two branches facing each other. They are thin and turn in a dorsad direction.

LOCALITIES.—V–14–Sat3, V–19–28, V–19–31.

TYPES.—Figured hypotypes: 550547a–c.

Family MACANDREVIIDAE, new family

Aberrant Terebratellacea, having the hinge plates extended directly to the valve floor and without a median septum. Loop development as in Dallinidae.

This name is proposed because of the great difference of the cardinalia of *Macandrevia* from those of other Dallinidae. The cardinalia of *Dallina* have the hinge plates united with a median septum. *Terebratalia* also has aberrant cardinalia when compared with those of *Dallina*, which gives the name to the family.

Macandrevia americana Dall

PLATE 3: FIGURES 21–31

Eudesia fontaineana Dall [not d'Orbigny], 1890:722.
Macandrevia americana Dall, 1895:721, pl. 32: figs. 1, 4, 7; 1908:444; 1920:356.—Hertlein and Grant, 1944:154.

This is a very large *Macandrevia* with some resemblances to two large species from the Antarctic, but having important differences from both of them. The *Vema* specimens are subpentagonal in outline, with the greatest width at midvalve. The sides are somewhat narrowly rounded and taper posteriorly and anteriorly; the anterior margin is narrowed but truncated. The posterior margins make an angle of 97°. Anterior commissure rectimarginate. The color of the two specimens is pale yellowish. The shell is thin and delicate, the valves nearly equal in depth, the ventral valve slightly the deeper.

The interior of the pedicle valve is provided with small, delicate teeth and strong, short dental plates, not extending anterior to the delthyrial cavity. The dorsal valve has a long loop that is twice as long as wide (20 mm long by 10 mm wide), which occupies four-fifths the valve length. The plates supporting the crura (inner hinge plates?) are short, but are extended anteriorly as low ridges for about one-fifth the valve length. The descending and ascending branches of the loop are narrow, but the transverse band is fairly broad and bears two prominent dorsad projecting points, probably remnants of a hood. The anterior extremities of the loop are spinose.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Maximum width*	*Thickness*	*Apical angle*
550478a	29.2	26.5	26.1	12.5	97°
550478b	29.1	27.0	25.1	13.0	97°

LOCALITY.—V–17–12, V–18–27.

TYPES.—Figured hypotypes: USNM 550478a, b.

DISCUSSION.—The type specimens of *Macandrevia americana* are in the National Museum of Natural History (USNM 87547 and 110794). The former specimen is the holotype. Dall's figures (1895, pl. 32: figs. 1, 4, 7) do not have the correct proportions of the specimen and are illustrated as quite round in outline, whereas the holotype is more pentagonal and with a narrowed, truncated anterior end. The outline is like that of the *Vema* specimens, and the L/W proportions of the holotype (1.16) and those of the *Vema* specimens (1.12 and 1.16) are also identical. Other points of similarity appear in the profile, the apical angle (about 95°), and the loop in the dorsal valve. This measures 14 mm in length in a valve 20 mm long, and thus about 0.7 the valve length. The transverse band is provided with dorsad projecting points as in the *Vema* specimens, and the anterior extremities of the loop are spinose. The *Vema* specimens thus seem to be a larger development of *M. americana.* This is also seen in comparison with specimens of *M. americana diegensis,* a large form occurring off the California coast. This is very close to the *Vema* specimens in size and shape. The type is 29 mm long, 25 mm wide, and 14 mm thick. The greater thickness, a more broadly truncated anterior, and darker color are the chief differences between them.

Macandrevia vanhoeffeni Blochmann is a large Antarctic species found on the west side of the Ross Sea. It is larger than the *Vema* specimens, more rounded anteriorly, and with deeper valves. Another large species suggesting the *M. americana* of *Vema* is *M. lata* Thomson from off the Shackelton Glacier in the Davis Sea. Thomson (1918:33) states that his species "most resembles" *M. americana,* but the ventral valve is deeper, the sides are more evenly rounded, and the anterolateral margins do not taper, although the anterior is truncated.

Macandrevia cranium (Müller)

Terebratula cranium Müller, 1776:249, no. 3006.—Dall, 1920: 354 [for detailed synonymy].

This species is characterized by its oval outline and lenticular profile, the two valves being nearly equal in depth. The foramen is large and anteriorly open, with little or no development of deltidial plates. This species is fairly common in the north Atlantic and the coast of Norway, Scotland, Greenland, Ireland, Sicily, and Spain. The two *Vema* specimens come from off Nova Scotia and the south end of Greenland.

LOCALITIES.—V–16–48, V–16–49.

Macandrevia aff. *M. diamantina* Dall*

PLATE 5: FIGURES 1–6; PLATE 8: FIGURES 12, 13

Three specimens of this interesting abyssal form were taken northeast of the Cocos Island, Costa

* Described as *Notorygmia,* new genus, in Cooper, "Homeomorphy in Recent Deep-Sea Brachiopods," *Smithsonian Contributions to Paleobiology,* 11: 16 pages, 4 plates, 1972.

Rica. The species is known from the east-northeast side of Cocos Islands, from which Dall's types came, from off the coast of Peru, and off the west side of Dronning Maud Land (71°22'S, 16°34'W, according to Jackson, 1912:379). Two of the specimens collected by the *Vema* are small and so thin shelled that they are transparent. Their length and width are nearly equal and the specimens are oval to pentagonal in outline. The anterior commissure is broadly sulcate, but the dorsal valve is only gently flattened anteriorly to meet the ventrad fold of the ventral valve. The foramen is wide open as usual in the genus, and deltidial plates are not apparent. Neither are like Dall's types in coloring and outline.

A third specimen of this species is definitely an adult, measuring 17 mm long and 15 mm wide. The shell is thin and white, but much of the exterior is covered by a dark epidermis. The anterior commissure is strongly uniplicate and the anterior margin is somewhat nasute. This specimen is more like individuals seen from the Baja California Abyssal Plain and from the Antarctic. It is quite unlike Dall's types from the Cocos Ridge, northeast of Cocos Island, west of the Colombia shore.

Measurements (in mm).—USNM 550486a: length 13.3, dorsal valve length 11.8, maximum width 12.4, thickness 5.3. USNM 550486b: length 9.2, dorsal valve length 8.5, maximum width 9.0, thickness 3.5.

Locality.—V–15–38, V–15–61.

Types.—Figured hypotypes: USNM 550486a, b; 550557.

Discussion.—Two of the *Vema* specimens are young individuals, because the types attain a length of 18 mm and a width of 17 mm. The species as now understood consists of long, narrow forms as well as the nearly equidimensional types. The *Vema* specimens show a development toward elongation in their length/width indexes.

The *Vema* specimens are especially interesting as they are a sort of link in the distribution of this species. *Macandrevia "diamantina"* has recently been found off the coast of Baja California, farther northward on the abyssal plain, west of Los Angeles. Here it occurs with two homeomorphs: *Neorhynchia* and *Abyssothyris,* respectively an abyssal rhynchonellid and a short-looped terebratulid. This pair has also been taken off the Galapagos. Thus this third homeomorph: *Macandrevia "diamantina"* appears in the neighborhood of the Galapagos. All three also have been taken farther south, off the coast of Chile.

Macandrevia tenera (Jeffreys)

Plate 3: figures 9–15

Terebratula tenera Jeffreys, 1876:250; 1878:405, pl. 22: fig. 7.
Waldheimia (Macandrevia) tenera (Jeffreys) Davidson, 1887: 66, pl. 12: figs. 6–10.

This species is the smallest of the macandrevias and the poorest one known. One of the largest specimens in the *Vema* collection measures in mm: length 10.4, dorsal valve length 9.8, maximum width 10.0, thickness 5.2. The beak is very low and the foramen large and open, with a very slight development of deltidial plates. The valves are unequally biconvex, the ventral valve having the greater convexity and depth. Inside the ventral valve the teeth are small, and the dental plates short but strongly developed. Inside the dorsal valve the cardinal process is short but wide at the apex; the socket ridges are strong; the crura are short, the crural processes small and sharply pointed. The loop is long, occupying about 0.7 of the shell length. The anterior extremities of the loop bear a few short spines. The specimens were attached to small pebbles by a short pedicle.

Localities.—V–16–48, V–16–54, V–16–55.

Types.—Figured hypotypes: USNM 550475a, b, d.

Family TEREBRATELLIDAE King, 1850

Subfamily TEREBRATELLINAE King, 1850

Genus *Terebratella* d'Orbigny, 1847

Terebratella dorsata (Gmelin)

Plate 5: figures 32, 33; Plate 6: figures 17–22

Terebratella dorsata (Gmelin) Fischer and Oehlert, 1892:20 [for extensive synonymy], pls. 9, 10.—Ihering, 1903:327.—Jackson, 1912:383.—Dall, 1920:369.—Thomson, 1927:292.

This species has been so well described and illustrated by Fischer and Oehlert (1892) that it is not necessary to repeat their work. They also furnish a very extensive synonymy that covers the entire period up to the time of their work.

The *Vema* material comes chiefly from the east side of the Strait of Magellan and the east side of Argentina, Tierra del Fuego, and a few from off the west side of the Falkland Islands. The specimens are commonly whitish to brown in color, transverse, multicostellate, but with smooth umbones. The anterior commissure is sulcate and the degree of folding is variable, usually rather moderate. Specimens range in size from a few millimeters to 39 mm in the largest specimen. A few dead shells were present in most of the lots in which specimens were numerous. A few specimens were attached by a short, thick pedicle to their fellows or to pebbles. Inside the dorsal valve the loop is in the terebratelliform stage, that is in the final stage of attachment to median septum. None of the dead shells preserved a complete loop.

Terebratella often occurs with *Magellania venosa* (Solander), commonly attached to this large brachiopod. The young of the two genera are difficult to separate because the young *Terebratella* is often smooth and their loop stages are similar. Usually distinction can be made because the anterior part of the median septum of *Terebratella* extends considerably beyond the loop, whereas in *Magellania* the septum is anteriorly truncated.

Localities.—V–14–9, V–14–14, V–14–15, V–14–19, V–15–93, V–15–98, V–15–99, V–15–106, V–15–107, V–15–108, V–15–112, V–16–37, V–16–39, V–17–18, V–17–19, V–17–20, V–17–24, V–17–25, V–17–27, V–17–29, V–17–30, V–17–32, V–17–33, V–17–36, V–17–38, V–17–47, V–17–51, V–17–77, V–17–87, V–17–99, V–17–100, V–18–13, V–18–15, V–18–18.

Types.—Figured hypotypes: USNM 550465, 550512a–d.

Magellania venosa (Solander)

Plate 7: figures 21–29

Anomia venosa Solander, 1789:355, pl. 11: fig. 3.
Magellania venosa (Solander) Fischer and Oehlert, 1892:60 [for extensive synonymy].—Jackson, 1912:387.
M. (Neothyris) venosa (Solander) Dall, 1920:362.

This is the largest known Recent brachiopod, which occurs in some abundance from Coquimbo, Chile, on the west coast of South America through the Straits of Magellan to the Falkland Islands and northward on the east coast of South America to beyond Mar del Plata, Argentina. It also occurs as far south as the Burdwood Bank, in depths ranging from 5 to 900 meters (McCammon and Buchsbaum, 1968:216). It is usually found in fairly shallow water, 13 to 80 meters (Fischer and Oehlert, 1892:65).

The species has a considerable size variation and to a lesser extent a variable shape. The largest specimen known to me (USNM 549733a) measures in mm: length 91, width 75, thickness 55, and comes from off Mar del Plata, Argentina, about the northern limit of its range. Another large specimen (USNM 549450) comes from the Falkland Islands and measures in mm: length 76, width 71, and thickness 44. The largest specimen known to Davidson (1886:71, pl. 8: figs. 2*a-c*) measured in mm: length 80, width 67, thickness 49. The largest specimens taken by the *Vema* measure about 2 inches in length. The largest specimen (USNM 550470) measures in mm: length 62, width 54, thickness 37.

McCammon and Buchsbaum (1968:221) studied the variation of three populations of *M. venosa* from the Strait of Magellan and found the variation small but nevertheless measurable and visible. Each of these variants appear in the *Vema* collections. Generally speaking young specimens tend to roundness, but the adults tend toward elongation.

The specimens collected by the *Vema* vary in color. The single specimen from V–17–89 (USNM 550470) is reddish in color and very distinctly so when wet. A specimen from V–14–2 is pale pink. The majority of specimens, however, range from pale yellow to light brown. Specimens from the Falklands and Mar del Plata are dark brown or grayish in color. In the vast range of *M. venosa,* it is likely that specific or subspecific separations may ultimately prove possible, but none of the collections available are geographically extensive enough to permit such a study.

Localities.—V–14–2, V–14–5, V–14–9, V–14–15, V–14–19, V–15–93, V–15–102, V–16–37, V–16–39, V–17–19, V–17–20, V–17–30, V–17–32, V–17–33, V–17–47, V–17–51, V–17–53, V–17–54, V–17–89, V–18–13, V–18–18, V–18–23, V–18–26.

Types.—Figured hypotypes: USNM 550466, 550467, 550468, 550474b, c, f, 550507.

Magellania species 1

PLATE 5: FIGURES 34, 35

Small, possibly a young individual, narrowly elliptical longitudinally; sides rounded and with the greatest width at about midvalve; posterolateral margins forming an angle of 77°. Anterior narrowly rounded and subnasute. Anterior commissure narrowly sulcate. Beak elongated, suberect; foramen large; deltidial plates large, disjunct. Color a pale pink blush; surface faintly and irregularly costellate. Growth increments strong and fairly regular.

Interior with strong median septum to which the long loop is attached. Cardinalia with excavated hinge plates form a V-shaped chamber connected with the median septum. Cardinal process small.

LOCALITY.—V–16–31.

MEASUREMENTS (in mm).—Length 14.2, dorsal valve length 12.2, width 11.0, thickness 7.0.

TYPES.—Figured specimen: USNM 550580.

REMARKS.—This species is represented by seven specimens, only one of which may be an adult. Four are definitely juvenile. One of the juveniles, 7 mm long and 7 mm wide, has a large, thick hood with long attachment to the median septum.

This species is difficult to place generically as its cardinalia are like those of *Waltonia, Aneboconcha,* and *Magellania.* Externally the largest specimen is like *Waltonia inconspicua* but narrower than usual. It also differs in having indistinct radii. Its loop development at 7 mm of length is entirely unlike that of *Waltonia* in having a more massive hood and in not having a projection of the septum anterior to the hood. It also differs from *Aneboconcha* in its adult loop development. Otherwise, except for the radii, it is an almost exact homeomorph. *Magellania* in the adult has a free loop, but in the young the loop is attached to the median septum. Furthermore the adult *Magellania* has conjunct deltidial plates. In the young these are disjunct. The nearest genus to which this species can be referred is *Magellania* (a young individual).

This specimen is probably related to *M. flavescens,* but not to *M. venosa,* which appears to be an entirely different stock from the Australia megallanias.

Magellania species 2

PLATE 3: FIGURES 16–20

About usual size for the genus, roundly oval in outline, with the length greater than the maximum width, which is at midvalve. Sides and anterior margin well rounded; posterolateral margins forming an angle of 85°. Anterior commissure faintly sulcate. Beak low, truncated by a large foramen that is open to the dorsal umbo, which forms its anterior margin; deltidial plates absent. Color yellowish white, but with remnants of a dark brown epidermis. Surface smooth except for lines of growth. Puncta small and dense.

Ventral valve evenly and gently convex in lateral profile, but moderately domed in anterior profile, with the median part of the dome narrowed and with long slopes. Beak, umbonal and median regions swollen, the swelling decreasing anteriorly.

Dorsal valve gently convex in lateral profile, with the maximum convexity in the posterior region; anterior profile evenly and broadly convex; umbonal and median regions gently inflated, the swelling decreasing anteriorly.

Ventral valve interior without dental plates; dorsal valve interior with terebratellid cardinalia, the inner hinge plates uniting anteriorly with a low median septum; loop terebratellid, with thin, delicate descending lamellae tied anterior to the median septum, which at its anterior end is still rather low, but more elevated than posteriorly. Ascending elements broader than the descending ones; loop, in its delicate character, suggesting an adult form.

MEASUREMENTS (in mm).—Figured specimen: length 15.5, dorsal valve length 13.5, width 13.0, thickness 7.0, apical angle 85°

LOCALITY.—V–16–40.

DIAGNOSIS.—Elongate oval terebratellid with large foramen, no deltidial plates and delicate loop in terebratellid stage.

TYPES.—Figured specimen: USNM 550511.

DISCUSSION AND COMPARISON.—The combination of characters in this specimen make a positive identification difficult. At first glance it suggests the young of *Magellania venosa* (Solander), but the outline is wrong; that of *M. venosa* is widely oval rather than elongate oval. Furthermore this specimen has no dental plates, but at the same size *M.*

venosa is supplied with prominent dental plates. The loop and cardinalia are like those of a young *M. venosa*. The anterior commissure is faintly sulcate. Reference to *Magellania* with relationship to *M. venosa* seems the best placement for this specimen.

Aneboconcha, new genus

[Greek "anebos" (immature)]

Small, elongate oval in outline with unequally deep valves, the ventral valve being the deeper of the two. Beak suberect, fairly long; foramen large, submesothyridid; deltidial plates small, disjunct, possibly conjunct in old adults. Anterior commissure sulcate. Exterior smooth except for incremental growth lines; punctation dense.

Ventral valve interior with elongated, narrow teeth but no dental plates. Pedicle collar rudimentary. Dorsal valve interior with wide, large semicircular cardinal process; thin, narrow socket ridges; outer hinge plates very narrow; crural bases narrow, supported by large convergent plates (inner hinge plates ?) which unite with a thin and delicate median septum; loop terebratelliform, delicate with slender ribbons and slender attachments between the descending lamellae and the median septum.

TYPE-SPECIES.—*Aneboconcha obscura,* new species.

DIAGNOSIS.—Small, smooth, sulcate brachiopods with terebratelliform loop.

COMPARISON AND DISCUSSION.—This little shell has the general appearance of *Magadina* or *Nipponithyris,* both of which are sulcate but which have entirely different loops. The loop of *Aneboconcha* is definitely terebratelloid, and the species occurs in the geographic area with *Magellania* and *Terebratella.* It is clear that it is not the young of either of these because of difference in shape, ornament, and stage of loop development. *Aneboconcha* is suggestive of *Glaciarcula,* as it has the same form and outline and a similar beak. The loop of *Glaciarcula* is terebrataliform, much stouter than that of the austral shell and with short, thick attachments to the median septum. The loop of *Aneboconcha* is the final stage in this small shell. The combination of characters of small size, oval outline, inequivalve, sulcate, with disjunct deltidial plates, and with terebratelliform loop distinguishes this shell from other terebratellid adults and their young.

Aneboconcha obscura, new species

PLATE 1: FIGURES 9–14; PLATE 4: FIGURES 1, 9, 10; PLATE 5: FIGURES 7–18; PLATE 6: FIGURES 30–35

Magellania sp. Blochmann, 1912:9, pl. 1: fig. 15.—Jackson, 1912:385, pl. 2: fig. 10.

Small, white, slightly over one-half inch in length (15 mm), oval in outline, with the length exceeding the width; sides rounded; anterior margin narrowly rounded to nasute; posterolateral margins forming an angle of 70° to 80°. Maximum width at midvalve. Beak erect, truncated; foramen round, fairly large; deltidial plates disjunct. Anterior commissure gently sulcate. Surface smooth. Puncta fine and closely crowded.

Ventral valve fairly evenly and moderately convex, with the most convexity in the umbonal region; anterior profile forming a low, sharp dome, narrowly convex medially and with long moderately steep slopes. Umbonal region narrowly convex and swollen, the swelling continuing anteriorly to the front margin to form a fold best defined in the anterior half. Lateral slopes gently convex, moderately steep.

Dorsal valve unevenly convex in lateral profile, with the maximum convexity in the posterior half; anterior profile broadly but moderately convex, with a slight depression at midvalve. Umbonal region gently inflated; sulcus originating on the umbonal region, widening to the anterior margin where it forms a shallow sulcus. Lateral slopes moderately steep.

Ventral valve with strong teeth, no dental plates and a very short pedicle collar. Cardinal process large, semicircular. Cardinalia with low, narrow socket ridges, small outer hinge plates but crural bases supported by concave plates that join the median septum. Crura short, crural processes slender and sharply pointed; descending branches narrow ribbons attached to the median septum by delicate cross bars; ascending branches moderately wide. Loop in terebratelliform stage and occupying about 0.7 the valve length.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Maximum width*	*Thickness*	*Apical angle*
550487a	15.5	13.6	13.2	7.6	81°
550487d	15.4	13.5	12.5	?	80°
550487e	15.1	12.8	11.8	7.8	75°

DEVELOPMENT OF THE LOOP.—The development of the loop of *Aneboconcha* is like that of *Magellania venosa* (Solander) and *Terebratella dorsata* (Gmelin), in both of which it occurs. Although the posterior of immature *Terebratella dorsata* is smooth, the early marginal development of costae will usually separate its young from those of *Aneboconcha*. Separation of the early immature stages of *Magellania venosa* from those of *Aneboconcha* is more difficult. The earliest stages of the two are nearly identical. After about 6 mm of growth it is usually not difficult to separate the two because *Magellania venosa* widens with growth, while *Aneboconcha* becomes elongate oval. Moreover the development of the loop is more rapid in *Aneboconcha* because it reaches a terebratelliform stage at about 10 mm of length, whereas *Magellania venosa* passes through the terebratelliform stage between 15 and 20 mm. After 20 mm the lateral cross bars of the loop are gradually resorbed and the loop becomes free.

The smallest *Aneboconcha* (USNM 550513) is 3.8 mm long by 3.3 mm wide and has a strong pillar with tiny ring bud on its ventrad extremity (Plate 6: figures 30–35). The base of the ring is next to the septum which is broad, but the transverse ribbon is flattened, thin, and delicate. The descending branches have not yet reached the septum. This is the premagadiniform stage.

The next largest specimen, 5 mm long by 4 mm wide (USNM 550488b), has a loop in the pregadiniform stage, with a broadened ring having a delicate transverse band and the descending branches not quite in contact with the septum (Plate 4: figure 1). The next largest specimen (USNM 550487c) is 6 mm long by 4.5 mm wide and has a loop in the magelliform stage, with a considerably expanded ring and the descending branches united with the septum just below the ring (see Plate 4: figures 9, 10). A still larger specimen, 10.5 mm long by 8.5 wide (USNM 550487c), has a terebratelliform loop with descending branches joined to the ascending lamellae and anteriorly free of the median septum, but the descending branches attached to the median septum by delicate cross bars. The largest specimen with loop (USNM 550487d) is 15.4 mm long by 12.5 mm wide and has an advanced terebratelliform loop, consisting of very delicate ribbons. (see Plate 5: figures 15, 18).

These developmental stages of *Aneboconcha* may be compared with those of *Magellania venosa* figured on Plate 7. The specimen of figure 25 is comparable to the 5×4 mm premagadiniform stage of *Aneboconcha;* the specimen shown by figure 26 is comparable to the 6×4.5 mm magelliform stage of *Magellania venosa*; the specimen illustrated by figure 27 corresponds to the 10.5×8.5 stage of *Aneboconcha*. The latter has now reached the terebratelliform stage, but the *Magellania* is still in the magelliform stage. Figure 28 shows a specimen comparable to the largest *Aneboconcha* with a late terebratelliform stage, but the *Magellania* loop is still in the magelliform stage. The adult free loop of *Magellania venosa* is shown in figure 29.

LOCALITIES.—V–14–2, V–15–98, V–15–112, V–17–51, V–17–52, V–18–16, V–18–27, V–18–32, Y–2–11.

DIAGNOSIS.—Small, oval, sulcate, with terebratelliform loop.

TYPES.—Holotype: USNM 550487a. Figured paratypes: USNM 550487b-e, 550488b, 550513. Unfigured paratype: USNM 550488a.

COMPARISON AND DISCUSSION.—This interesting little species was noticed by Blochmann (1912:9) and Jackson (1912:385), but they were unable to place it generically. In exterior form it suggests some species of *Liothyrella,* but the strong median septum, easily visible in the wet shell, separates it immediately. As remarked by Jackson, it cannot be the young stage of *Magellania venosa* because the shell is too narrow for the young of *Magellania* at the stage of loop development exhibited. The loop appears to be an adult loop because of its slender ribbon and the very tenuous lateral supports of the

descending branches. I have been unable to find a species with comparable characters with which to compare *A. obscura*. Specimens of comparable appearance have proved generically different and thus not strictly to be compared.

Subfamily MAGADINAE Davidson, 1886

Genus *Magadina* Thomson, 1915

Magadina cumingi (Davidson)

PLATE 5: FIGURES 39–42

Terebratella? cumingi Davidson, 1852a:368; 1852b:78, pl. 14: figs. 10.16.
Magasella cumingi (Davidson) 1886:97, pl. 17: figs. 23–32 [detailed synonymy].
Magadina cumingi (Davidson) Thomson, 1915:400, fig. 12; 1927:274.

Several dorsal valves of this species were taken south of Melbourne, Australia. The specimens are waterworn and only dorsal valves are present. These, however, show the heavily calcified cardinalia and thick, shelflike cardinal process. The median septum is very thick.

The *Vema* specimens come from Bass Strait, which is the location from which the poorly known *M. fibula* (Reeve) came. This species is said by Davidson (1886:97) to differ so slightly from *M. cumingi* that he synonymized the two. Inasmuch as the differences between these two species depend in part on the beak characters of the ventral valve, it is not possible to settle the matter here. The dorsal valves are certainly very close to *M. cumingi*.

LOCALITY.—V–18–107.

TYPES.—Figured hypotypes: USNM 128938, 465460a, 550553.

Genus and Species Undetermined

PLATE 6: FIGURES 13–16

A small, smooth specimen occurring with *Dyscolia vema,* new species, adds a fourth associate to that unusual species. This specimen is smooth, elongate oval, longer than wide, maximum width at midvalve. The beak is erect, the foramen large, mesothyridid, with disjunct deltidial plates. The anterior commissure has a gentle dorsad wave. Puncta small and closely crowded. The ventral valve is deeper than the gently convex dorsal valve. The anterior profile of the ventral valve is strongly domed, but that of the dorsal valve is gently and broadly domed.

Inside the ventral valve there are no dental plates. The interior of the dorsal valve has concave inner hinge plates that are attached to the median septum. The loop is attached to a low median septum and is in a late magelliform stage or an early terebratelliform stage with thick attachments to the septum, broad descending lamellae, and a broad hood.

MEASUREMENTS (in mm).—Length 11.3, dorsal valve length 10.0, width 8.7, thickness 6.6, apical angle 75°.

LOCALITY.—V–17–14RD.

TYPES.—Figured specimen: USNM 550509.

DISCUSSION.—This little shell suggests a member of the genus *Campages,* but its uniplicate commissure eliminates this possibility. The specimen is unfortunately badly damaged but its characters are definite. The specimen has adult characters, but its loop with the large hood, probably in magelliform stage, does not conform to any young of the genera so far found along the Argentine coast. Understanding must await more specimens.

Genus and Species Undetermined = Immature Terebratulacean

PLATE 6: FIGURES 1–12

Small, suggesting *Cryptopora* at first glance, but with a wide-angled beak (110°) and narrow, flat strongly spsacline interareas; sides gently convex; anterior margin rounded. Anterior commissure rectimarginate; foramen large, deltoid, and without trace of deltidial plates. Surface smooth. Inner layer of shell strongly fibrous; lamellar layer translucent. Inner layer with large, round pores.

Ventral valve interior unknown. Dorsal valve with a strong socket ridge, deep, open sockets, and long, narrow crura extending obliquely medially; crus rounded at base and tapering to a point. Median septum originating well anterior to the notothyrial cavity, rising rapidly to a sharp point and descending steeply at about midvalve, somewhat flattened on its posterior edge. Lophophore a simple ring.

MEASUREMENTS (in mm).—

USNM specimens	*Length*	*Dorsal valve length*	*Width*	*Thickness*	*Apical angle*
550502a	2.3	2.1	1.9	0.7	110°
550502b	1.7	1.6	1.4	0.5	110°
550502c	?	3.1	2.5?	?	?

LOCALITY.—Theta–1–6.

TYPES.—Figured specimens: 550502 a–d.

DISCUSSION.—All of the features of these tiny specimens suggest the early growth stage of a terebratulacean. The inwardly pointing crura, high pillar-like septum, coarse punctae, and wide foramen without deltidial plates are all indications of terebratulacean immaturity. The young of *Dallina floridana,* a species common in the Caribbean and Straits of Florida, are very suggestive, but that species has not been seen so far north nor in such deep water. A more likely possibility is that these are the young of *Macandrevia,* a common dweller of the abyss.

Literature Cited

Adams, A., and L. A. Reeve

1850. Mollusca. *In Zoology of the Voyage of H. M. S. Samarang; under the Command of Captain Sir Edward Belcher . . during the* Years 1843–1846. 88 pages, 24 plates. [Brachiopods, pages 71, 72, plate 21.] London.

Atkins, D.

1959. The Growth Stages of the Lophophore of the Brachiopods *Platidia davidsoni* (Eudes Deslongchamps) and *Platidia anomioides* (Philippi), with Notes on the Feeding Mechanism. *Journal of the Marine Biological Association of the United Kingdom,* 38:103–132.

Blochmann, F.

1906. Neue Brachiopoden der Valdivia und Gaussexpedition. *Zoologische Anzeiger,* 30 (21/22):690–702.

1908. Zur Systematik und geographischen Verbreitung der Brachiopoden. *Zeitschrift für wissenschaftliche Zoologie, Leipzig,* 90:596–644, plates.

1912. Die Brachiopoden der Schwedischen Südpolarexpedition. *Wissenschaftliche Ergebnisse der Schwedischen Südpolarexpedition, 1901-1903,* 6 (7): 12 pages, 3 plates.

Broderip, W. J.

1834. Descriptions of Some New Species of Cuvier's Family of Brachiopoda. *Proceedings of the Zoological Society of London,* 1:124.

1835. Descriptions of Some New Species of Cuvier's Family of Brachiopoda. *Transactions of the Zoological Society of London,* 1:141–164, plates 22, 23.

Cooper, G. A.

1954. Gulf of Mexico, Its Origin, Waters and Marine Life. Brachiopoda Occurring in the Gulf of Mexico. *Fish and Wildlife Service, Fishery Bulletin,* 55:363–365.

1959. Genera of Recent Rhynchonelloid Brachiopods. *Smithsonian Miscellaneous Collections,* 139 (5): 90 pages, 22 plates.

Couthouy, P.

1838. Description of New Species of Mollusca and Shells, and Remarks on Several Polypi, Found in Massachusetts Bay. *Boston Journal of Natural History,* 2:53–111, 3 plates.

Crosse, H.

1865. Description d'espèces nouvelles de la Guadeloupe. *Journal of Conchyliologie,* 3 (5):27–38, 1 plate.

Dall, W. H.

1871. Report on Brachiopoda of the Straits of Florida, in Charge of L. F. Pourtales, with a Revision of the Craniidae and Discinidae Obtained by the U. S. Coast Survey Expedition. *Bulletin of the Museum of Comparative Zoology, Harvard,* 3 (1): 45 pages, 2 plates.

1890. Scientific Results of Exploration by the U. S. Fish Commission Steamer *Albatross.* VII: Preliminary Report on the Collection of Mollusca and Brachiopoda Obtained in 1887–88. *Proceedings of the United States National Museum,* 12 (773):219–362, plates 5–14.

1895. Report on Mollusca and Brachiopoda Dredged in Deep Water, Chiefly Near the Hawaiian Islands, with Illustrations of Hitherto Unfigured Species from Northwest North America (*Albatross* Expeditions). *Proceedings of the United States National Museum,* 17:675–733, plates 30–32.

1900. Some Names Which Must Be Discarded. *Nautilus,* 44:44, 45.

1902. Illustrations and Descriptions of New, Unfigured, or Imperfectly Known Shells, Chiefly American, in the United States National Museum. *Proceedings of the United States National Museum,* 24:499–566.

1903. Synopsis of the Family Astartidae, with a Review of American Species (*Crania patagonica* Dall). *Proceedings of the United States National Museum,* 26:950, plate 62, figures 1, 3.

Dall, W. H.

1908. The Mollusca and Brachiopoda (*Albatross* Expeditions). *Bulletin of the Museum of Comparative Zoology, Harvard,* 43:205–487.

1920. Annotated List of the Recent Brachiopoda in the Collection of the United States National Museum, with Descriptions of Thirty-three New Forms. *Proceedings of the United States National Museum,* 57:261–377.

Davidson, T.

1852a. Sketch of a Classification of Recent Brachiopoda Based upon Internal Organization. *Annals and Magazine of Natural History,* 2nd series, 9:361–377.

1852b. Description of a Few New Recent Species of Brachiopoda. *Proceedings of the Zoological Society of London,* 20:75–83.

1855. A Few Remarks on the Brachiopoda. *Annals and Magazine of Natural History,* 2nd series, 16:425–429, plate 10.

1878. Preliminary Report on the Brachiopoda Dredged by H. M. S. *Challenger. Proceedings of the Royal Society of London,* 27 (188) :428–439.

1880. Report on the Brachiopoda. In *The Voyage of H. M. S. Challenger.* Zoology, 1: 67 pages, 4 plates.

1886-1888. A Monograph of Recent Brachiopoda. *Transactions of the Linnaean Society of London,* series 2, Zoology, 1: 248 pages, 30 plates.

Deslongchamps, Eude E.

1855. On a New Species of *Morrisia. In* Davidson, 1855, op. cit., pages 443, 444, plate 10: figures 20, 20*a-d.*

1884. Étude critique sur des brachiopodes nouveaux ou peu connues. *Bulletin de la Société Linnéenne de Normandie, Caen,* series 2, VIII(Note sur les modifications à porter à la classification des Terebratulidae):77–213. [*Mergerlina,* page 159.]

Fischer, P.

1872. Brachiopodes des cotes océanique de France. *Journal de Conchyliologie,* 3 (2a):160–164, plate 6.

Fischer, P., and D. P. Oehlert

1890. Diagnoses de nouveaux Brachiopodes. *Journal de Conchyliologie,* 38:70–74.

1891. *Expéditions scientifiques du* Travailleur *et du* Talisman *pendant les années* 1880–1883. 140 pages, 8 plates. Paris.

1892. Brachiopodes. *In* Mission scientifique du Cape Horn (1882–1883) . *Société Histoire Naturelle Autun (1892)* , 5: 82 pages, plates 8–12.

Foster, M. W.

1968. Harvard University's Brachiopod Studies on *Eltanin* Cruise 32. *Antarctic Journal of the United States,* September-October: 160.

1969. Distribution of Selected Groups of Marine Invertebrates in Waters South of 35° Latitude, *American Geographic Society Map Folio Series.* Brachiopoda, pages 21, 22, plate 9.

Gmelin, F. F.

1790. *In* Linnaeus, *Systema Naturae, sive Regna tria Naturae systematice proposita per Classes, Ordines, Genera et Species (Anomia psittacea* Gmelin) . Edition XIII, 1 (6) 3348. Leipzig.

Helmcke, J. G.

1938. Die Brachiopoden der zoologischen Museums zu Berlin. *Sitzungsberichte der Gesellschaft Naturforschender Freunde für Berlin for 1938*:221–268.

1939. Brachiopoda. *In* W Kükenthal und T. Krumbach, *Handbuch der Zoologie,* 3 (2):139–258, figures 152–271. Berlin.

1940. Die Brachiopoden der Deutschen Tiefsee-Expedition. *IWissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer Valdivia, 1898–1899*:217–316, 43 figures.

Hertlein, L. G., and U. S. Grant IV.

1944. The Cenozoic Brachiopoda of Western North America. *Publications of the University of California at Los Angeles in Mathematical and Physical Sciences,* 3: 236 pages, 21 plates.

Ihering, H. von.

1903. Les Brachiopodes Tertiares de Patagonie. *Anales del Museo Nacional de Buenas Aires,* 3 (2) :321–349, plate 3.

Jackson, J. W.

1912. The Brachiopods of the Scottish National Antarctic Expedition. *Transactions of the Royal Society of Edinburgh,* part 2, 48 (19):367–390, 2 plates.

1952. A Revision of Some South African Brachiopods, with Descriptions of New Species. *Annals of the South African Museum,* 41 (1) : 40 pages, 3 plates.

Jeffreys, G.

1869. The Deep-sea Dredgings. *In* Explorations on H. M. S. *Porcupine. Nature,* 1: 136.

1870. Preliminary Report of the Scientific Exploration of the Deep Sea in H. M. S. Surveying Vessel *Porcupine* during the Summer of 1869. *Proceedings of the Royal Society of London,* 18 (121): 421.

1876. On Some New and Remarkable North-Atlantic Brachiopoda. *Annals and Magazine of Natural History,* series 4, 18:250–253.

1878. On the Mollusca Procured during the *"Lightning"* and *"Porcupine"* Expeditions, 1868–1870. *Proceedings of the Zoological Society of London,* 1878:393–416, plates 22, 23.

King, W.

1868. On Some Palliobranchiate Shells from the Irish Atlantic. *Proceedings of the Natural History Society of Dublin,* (5) :170–173.

1871. On *Agulhasia davidsoni,* a New Palliobranchiate Genus and Species. *Annals and Magazine of Natural History,* series 4, 7:109–112, plate 11.

Krauss, F. von.

1844-1848a. Brachiopoda. Volume 7 *in* H. C. Küster, *Conchylin-Cabinet von Martini und Chemnitz.* 1844 (plates) ; 1848 (text) .

1848b. *Die Sudafrikanischen Mollusken.* 140 pages, 6 plates.

McCammon, H., and, R. Buchsbaum

1968. *Size and Shape Variation of Three Recent Brachiopods from the Strait of Magellan.* Antarctic Research Studies (11) , Biology of the Antarctic Seas III, American Geophysical Union.

Monterosato, Marquis T. A. di

1879. Note sur les espèces du genre *Platidia. Journal de Conchyliologie,* series 3, 19: 306.

Muir-Wood, H. M.

1959. Report on the Brachiopoda of the John Murray Expedition. The *John Murray Expedition,* 1933–1934, *Science Reports,* 10 (6):283–317, 5 plates.

1960. Homeomorphy in Recent Brachiopoda: *Abyssothyris* and *Neorhynchia. Annals and Magazine of Natural History,* series 13, (3) :521–528, plate 7.

Müller, O. F.
1776. *Zoologiae Danicae Prodromus seu Animalium Daniae et Norvegiae indigenarum characteres, nomina, et synonyma imprimis popularium.* xxxii+282 pages. Havniae.

Oehlert, D. P.
1887. *In* P. Fischer, *Manual of Conchology.*

d'Orbigny, A.
1847. Sur les Brachiopodes ou Palliobranches. *Comptes Rendus Académie de Science,* Paris, 25 (7):266–269.

Pallas, P. S.
1766. *Miscellanea Zoologica, quibus imprimis et obscurae Animalium species descriuntus.* Page 82, plate 14.

Reeve, L. A.
1860-1861a. Terebratula. In *Conchologia Iconica, or Figures and Descriptions of Molluscous Animals.* Volume 13 of 23 volumes. London.
1861b. A Revision of the History, Synonymy and Geographic Distribution of the Recent Terebratulae. *Annals and Magazine of Natural History,* series 3, 7:169–190.

Scacchi, A., and R. A. Philippi
1844. *Enumeratio Molluscorum Siciliae.* Volume 2, 18 plates. Halle.

Smirnova, T. N.
1966. On the Systematics of the Early Cretaceous Terebratulids of the Subfamily Cancellothyrinae. *Paleontologicheskiy Zhurnal (Akademiya Nauk SSSR Paleontologicheskiy Institut),* 3:31–41, 8 figures.

Solander, D. C.
1789. *In* G. Dixon, *A Voyage Round the World.* Page 355, plate 11, figure 3.

Sowerby, G. B.
1847. *Thesaurus Conchology.* Volume 1, number 17, page 362, plate 71, figures 91, 92.
1897. Appendix. In *Marine Shells of Africa.* Page 28. London.

Stenzel, H. B.
1943. Brachiopoda, Eocene. In *Type Invertebrate Fossils of North America.* 27 cards numbered 122–148 (1–27), Austin, Texas: Texas Bureau of Economic Geology.

Thomson, J. A.
1915. The Position of Shells with Magaselliform Loops and of Shells with Bouchardiiform Beak Characters. *Transactions of the New Zealand Institute,* 47:392–403.
1918. Brachiopoda. *In* Australasian Antarctic Expedition, 1911–1914. *Scientific Reports, Series C, Zoology and Botany,* 4 (3):76 pages, plates 15–18.
1927. Brachiopod Morphology and Genera (Recent and Tertiary). *New Zealand Board of Science and Art, Manual* 7: 338 pages, 2 plates.

Turton, W. H.
1932. *The Marine Shells of Port Alfred, S. Africa (Brachiopoda).* Pages 259–260, plate 70.

Weinkauff, H. C.
1867. *Die Conchylien des Mittelmeeres, ihre geographische und geognostische Verbreitung.* 2 volumes. Cassel.

Williams, A., et al.
1965. Brachiopoda. Part H, *in* R. C. Moore, editor, *Treatise on Invertebrate Paleontology.* 2 volumes, 927 pages, 746 figures.

Zezina, O. N.
1965. The Distribution of the Deep Water Brachiopod Species *Pelagodiscus atlanticus* (King). *Okeanologiya,* 5 (2):345–358.
1970. Brachiopod Distribution in the Recent Ocean with Reference to Problems of Zoogeographic Zoning. *Paleontologicheskiy Zhurnal (Academiya Nauk SSSR Paleontologicheskiy Institut),* 2:1–21.

PLATE 1

Liothyrella, Aneboconcha, and *Liothyrella?*

Liothyrella oblonga, new species: 1–5, Side, posterior, anterior, dorsal, and ventral views of the holotype, showing its bulging sides and elongate forms, × 1, USNM 550498; 6, interior of the posterior of the ventral valve of the holotype, showing elongate teeth and labiate foramen, × 2; 7, 8, interior of the dorsal valve of the holotype, showing the wide loop, large crural processes, and their stubby points, × 1, × 2, [locality: V–14–14].

Aneboconcha obscura, new species: 9–13, Ventral, posterior, anterior, side, and dorsal views of a complete specimen, × 1, holotype USNM 550487a; 14, dorsal view of the preceding specimen, showing the cardinalia, × 2 [locality: V–17–51].

Liothyrella uva (Broderip): 15–17, Anterior, dorsal, and side views of a complete specimen, showing characteristic outline and profile, × 1, hypotype USNM 550492a; 18–20, side, anterior, and dorsal views of another characteristic specimen, × 1, hypotype USNM 550492b [locality: V–15–98].

Liothyrella? vema, new species: 21–25, Dorsal, ventral, anterior, posterior, and side views of a large slightly deformed specimen showing uniplicate anterior commissure, × 1, paratype USNM 550480b; 26, 27, interior of the dorsal valve of the preceding paratype, showing stout, narrow, slightly deformed loop, × 1, × 2; 28, interior of the ventral valve of the preceding paratype, showing adventitious growths in the muscle field, × 1; 29–33, ventral, dorsal, posterior, anterior, and side views of the holotype, showing uniplicate anterior commissure, × 1, USNM 550480a; 34, interior of the ventral valve of the holotype, × 1; 35, 36, interior of the dorsal valve of the holotype, showing undeformed stout loop with broad transverse band and wide outer hinge plates, × 1, × 2 [locality: V–17–61].

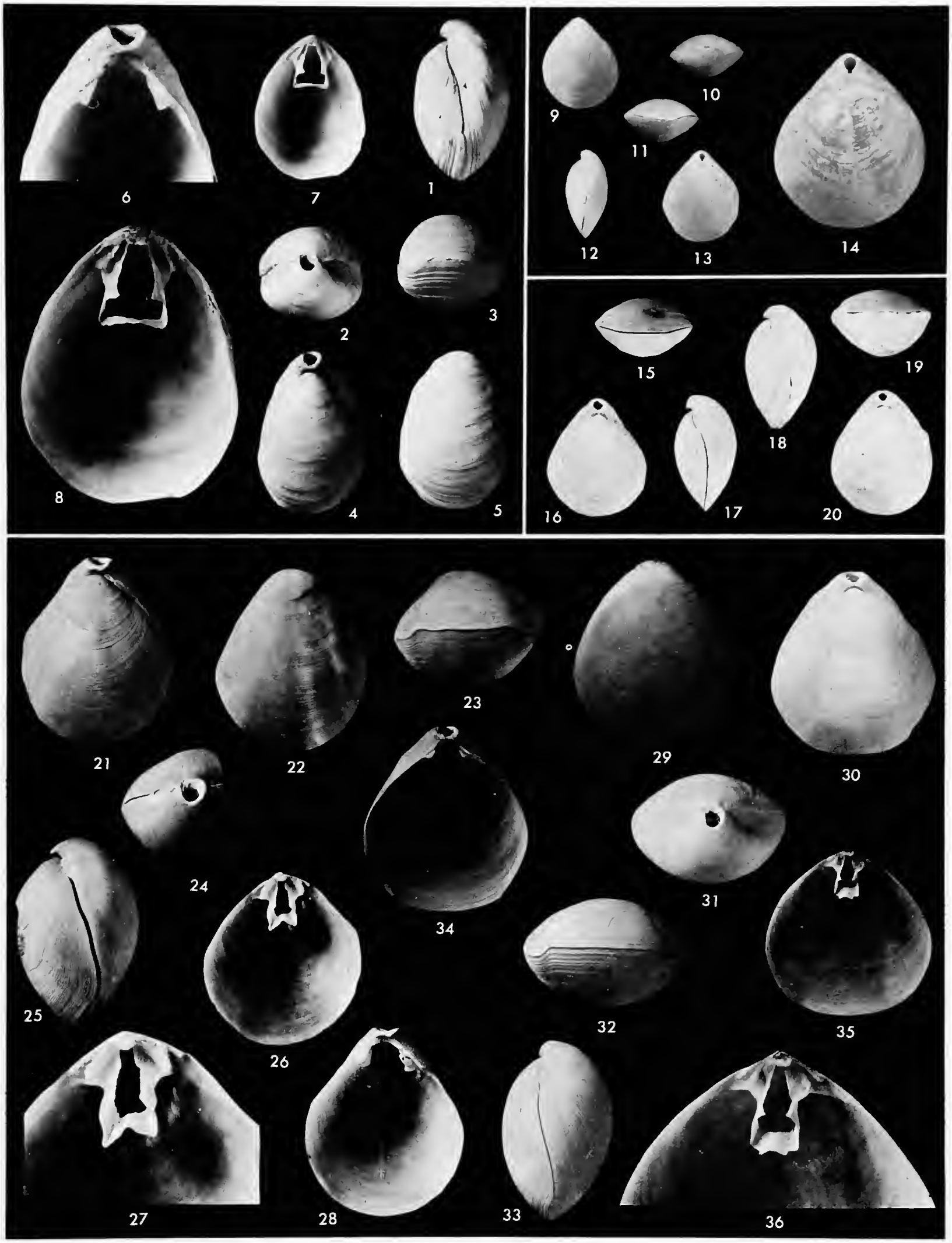

6
7
1
8
2
3
4
5
9
10
11
12
13
14
15
19
16
17
18
20
23
21
22
29
30
24
34
31
25
26
32
35
27
28
33
36

PLATE 2

Dyscolia

Dyscolia ewingi, new species: 1–5, Side, dorsal, ventral, anterior, and posterior views of an old and obese specimen much thickened on its margins, a feature characteristic of *Dyscolia,* × 1, paratype USNM 550461c; 6–10, posterior, ventral, anterior, side, and dorsal views of an immature individual, × 1, paratype USNM 550461d; 11, 12, interior of the dorsal and ventral valves of the preceding specimen, showing the immature loop, × 1; 13, interior of the preceding paratype, showing the rounded immature loop, × 2; 14–18, ventral, anterior, side, posterior, and dorsal views of the holotype, showing large foramen with thickened rim, × 1, USNM 550461a; 19, exterior of part of the holotype, showing characteristic ornament of *Dyscolia,* × 4; 20, posterior of the holotype, showing the labiate foramen and symphytium, × 2; 21, interior of the ventral valve of the holotype, × 1; 22, 23, interior of the dorsal valve of the holotype, showing the wide, rounded loop, and the very modest development of the hinge plate, × 1, × 2; 24–26, mat of mantle spicules and two individual spicules from the holotype, × 10, USNM 550461a′-a‴ [locality: V–17–RD14].


1
25
24
26
19
2
3
4
5
6
7
8
9
10
13
22
14
15
16
11
17
18
12
21
20
23

PLATE 3

Dyscolia, Macandrevia, Magellania

Dyscolia ewingi, new species: 1, 2, Interior of the ventral and dorsal valves, showing teeth and wide loop, × 1, paratype USNM 550461b; 3, ventral view of the loop of the preceding specimen, showing crural processes and hinge plates, × 2; 4–8, anterior, posterior, side, ventral, and dorsal views of the complete individual, × 1, paratype USNM 550461b [locality: V–17–RD14].

Macandrevia tenera (Jeffreys): 9–11, Anterior, side, and dorsal views of a complete specimen, × 1, hypotype USNM 550475a; 12, dorsal view of preceding specimen, × 2; 13, side view of another hypotype, × 2, USNM 550475b; 14, 15, interior of the dorsal and ventral valves, showing the loop with the spines on its anterior ends, the open foramen and teeth of the ventral valve, × 3, hypotype USNM 550475d [locality: V–16–55].

Magellania species 2: 16, Dorsal view of figured specimen, × 1, USNM 550511; 17–19, side, anterior, and dorsal views of figured specimen, × 2; 20, interior of figured specimen opened to show the terebratelliform loop, × 2 [locality: V–16–40].

Macandrevia americana Dall: 21–23, side, anterior, and dorsal views of a large, perfect example, showing open foramen and rectimarginate commissure, × 1, hypotype USNM 550478b; 24, 25, interior of the ventral valve of the preceding specimen, showing teeth and open foramen, × 1, × 2; 26, interior of the dorsal valve of the preceding specimen, showing the long loop, × 1; 27, 28, ventral and laterally tilted views of the preceding dorsal valve, showing the loop in greater detail, × 2 (note absence of median septum, small crural processes and small spines at the anterior ends of the loop); 29–31, side, anterior, and dorsal views of another large adult, × 1, USNM 550478a [locality: V–18–27].

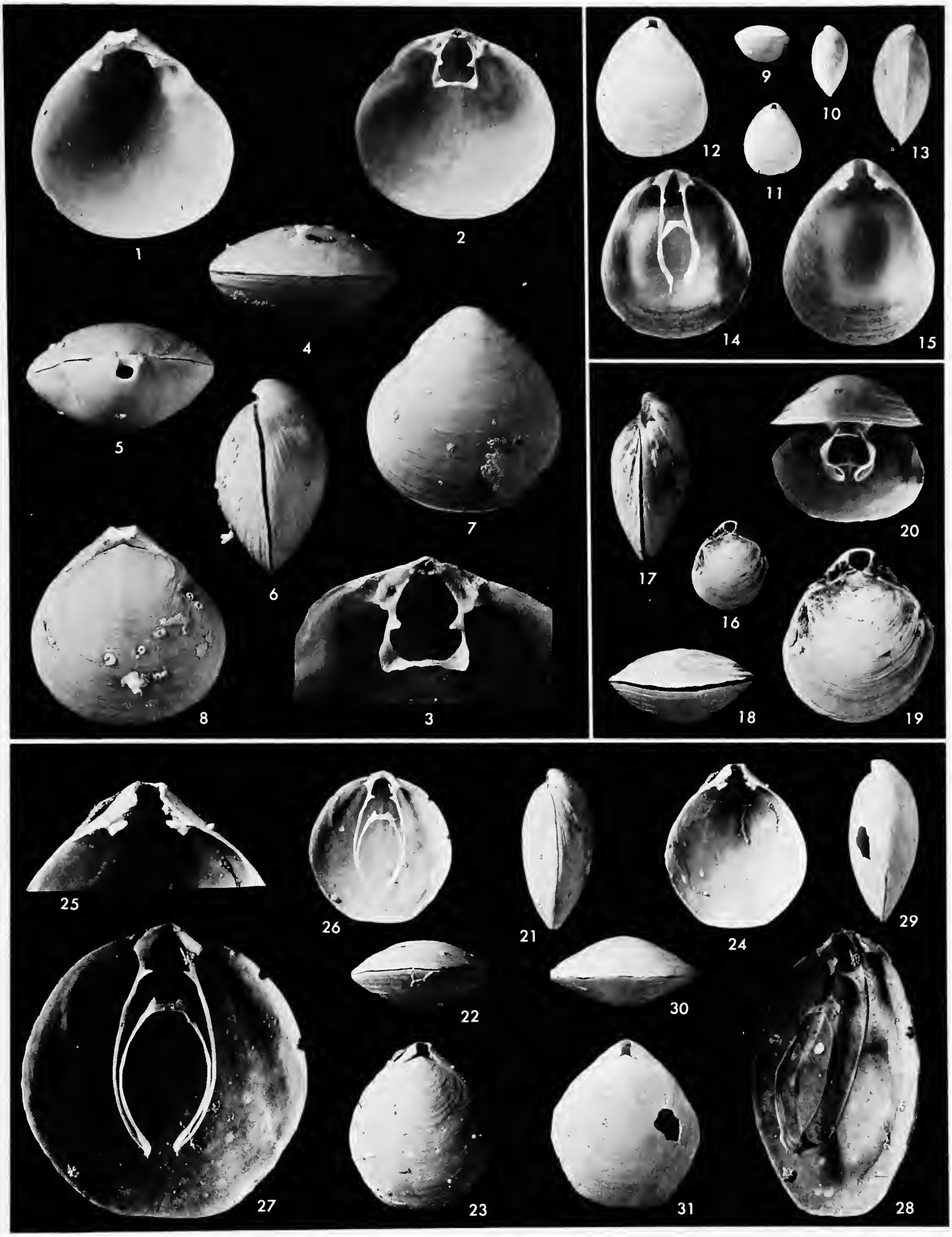

1
2
4
5
6
7
8
3
9
10
12
13
11
14
15
17
20
16
18
19
25
26
21
24
29
22
30
27
23
31
28

PLATE 4

Aneboconcha, Crania Chlidonophora, Eucalathis, and *Platidia*

Aneboconcha obscura, new species: 1, Interior of the dorsal valve of an immature specimen, showing an early loop stage in which the descending branches have not yet joined the septal pillar, × 6, paratype USNM 550488b; loop in late premagadiniform stage [locality: V–17–52].

Crania patagonica Dall and species: 2, Enlargement of exterior of a dorsal valve of *Crania patagonica* Dall, showing a patch of small spines, × 4, hypotype USNM 550482b from Y–2–8; 3, 4, *Crania* species aff. *C. patagonica,* interior and exterior of a small specimen, wrinkled but without spines, × 2, figured specimen USNM 550483a, from V–17–12; 5, 6, *Crania* species, exterior and interior of a specimen with distant, scattered spines, × 2 figured specimen USNM 550484 [locality: V–17–38].

Chlidonophora incerta (Davidson): 7, 8, Laterally tilted and ventral view of the dorsal valve interior, showing the narrow and pointed loop, × 4, hypotype USNM 550462c [locality: V–15–6].

Aneboconcha obscura, new species: 9, 10. Laterally tilted and ventral views of a young adult, showing loop in late magelliform stage, × 3, paratype USNM 550487b [locality: V–17–51].

Eucalathis inflata, new species: 11–13, Ventral, anterior, and laterally tilted views of the dorsal interior, showing the very stout and pointed loop, holotype USNM 550479a [locality: V–17–RD14].

Eucalathis? species: 14, 15, Interior and exterior of the dorsal valve showing terebratulinid, stout socket ridges and delicate crura, × 10, figured specimen USNM 550508; 16, 17, interior and exterior of the ventral valve showing thick, massive, and wide symphytium, long, thin pedicle, and wide teeth, counterpart to preceding dorsal valve, × 10 [locality: V–15–155].

Platidia davidsoni (Deslongchamps): 18, 19, Ventral and side views of the ventral valve, × 5, hypotype USNM 550481a; 20, interior of the ventral valve of the same, showing interareas, × 10; 21, 22, exterior of the dorsal valve, × 5, and interior, × 10, showing pedicle and lophophore of the hypotype: 23–25, ventral, dorsal, and side views of a complete individual, showing large triangular foramen with pedicle in place, × 5, hypotype USNM 550481b; 26, dorsal view of the preceding hypotype, showing dorsal pedicle opening and pedicle in place, × 10; 27, exterior of the ventral valve of the preceding specimen, showing concentric ornament, × 10; 28, 29, anterior and laterally tilted views of a dorsal valve, preserving the complete loop, × 10, hypotype USNM 550481c (for additional views, see Plate 5: figures 37–38) [locality: V–17–RD14].

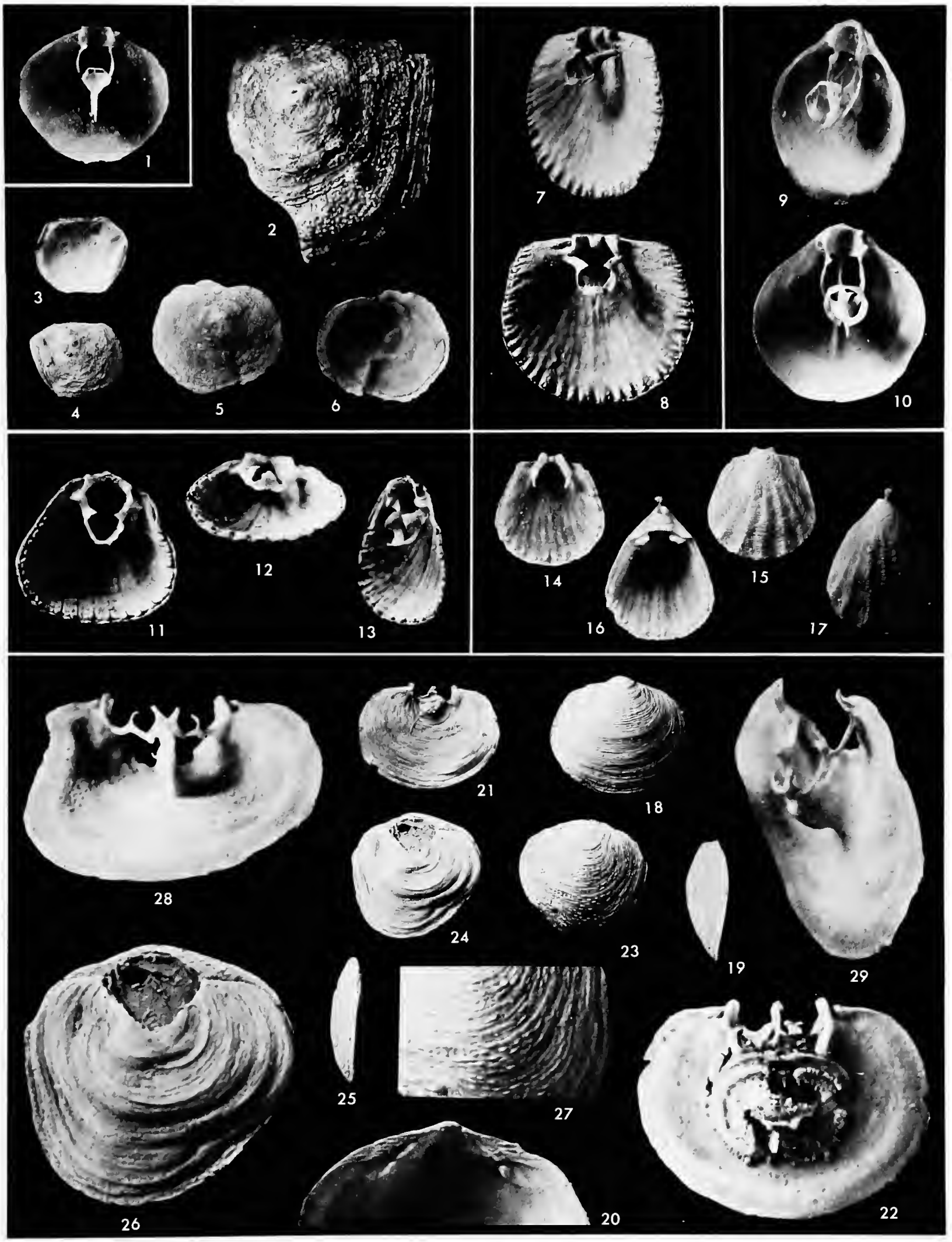

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

PLATE 5

Macandrevia, Aneboconoha, Neorhynchia, Chlidonophora, Terebratella, Magellania, Pelagodiscus, Platidia, and *Magadina*

Macandrevia aff. *M. diamantina* Dall: 1–3, Dorsal, side, and ventral views of an adult, × 1, hypotype USNM 550557 (for interior, see Plate 8: figures 12, 13) [locality: V–15–38]. 4, Dorsal view of a young specimen, × 1, hypotype USNM 550486b; 5, anterior view of the preceding specimen, showing sulcate anterior commissure, × 2; 6, dorsal view of another specimen, damaged on the side, × 2, hypotype USNM 550486a [locality: V–15–61].

Aneboconcha obscura, new species: 7–9, Anterior, side, and dorsal views of the paratype, × 1, USNM 550487e; 10–14, side, anterior, posterior, dorsal, and ventral views of the paratype, showing the sulcate anterior commissure, × 2; 15. 16, interior of the dorsal and ventral valves showing early terebratelliform loop and disjunct deltidial plates, × 3, paratype USNM 550487c; 17, 18, interior of the ventral and dorsal valves of another individual, showing a more advanced terebratelliform loop (for additional stages of the loop development, see Plate 4: figures 1, 9, 10, and Plate 6: figures 30–34), × 2, paratype USNM 550487d [locality: V–17–51].

Neorhynchia strebeli (Dall): 19, Dorsal view of a young specimen, × 1, hypotype USNM 550505; 20–23, dorsal, anterior, side, and ventral views of the preceding specimen, showing the broadly and deeply sulcate anterior commissure, × 2 [locality: X–17–1].

Chlidonophora incerta (Davidson): 24–26, Anterior, side, and dorsal views of a complete specimen, × 3, hypotype USNM 550463a; 30, dorsal view of a large specimen, attached to a ventral valve of another *Chlidonophora* by strands of its frayed pedicle, × 4, hypotype USNM 550463b [locality: V–15–12]. 27–29, Anterior, side, and dorsal views of another complete specimen, without pedicle and showing form reminiscent of the Paleozoic dalmanellids, × 3, hypotype USNM 550462*c* (for interior see plate 4: figures 7, 8) [locality: V–15–6]. 31, Dorsal view of another complete specimen, showing strands of frayed pedicle attaching to Foraminifera in a manner similar to that of *C. chuni* (Blochmann) from the Indian Ocean, × 4, hypotype USNM 550464 [locality: V–15–11].

Terebratella dorsata (Gmelin): 32, Dorsal view of a complete specimen, showing lack of radial ornament and large foramen, × 1, hypotype USNM 550465; 33, interior of the dorsal valve of the preceding specimen, showing characteristic terebratellid cardinalia, × 1, [locality: V–17–47].

Magellania (ss) species 1: 34, 35, Dorsal and side views of a complete specimen, showing obscure radial ornament, × 2, figured specimen USNM 550580 [locality: V–16–31].

Pelagodiscus atlanticus (W. King): 36, Ventral view, showing long setae and pedicle (central dark splotch); photo under alcohol, × 6, hypotype USNM 550581 [locality: T–1–6].

Platidia davidsoni (Deslongchamps): 37, Ventral view of a complete specimen attached to *Dyscolia vema* Cooper, hypotype USNM 550481a; 38, interior of the dorsal valve of a hypotype, × 10, USNM 550481c, showing ventral view of loop (for additional views of the loop, see Plate 4: figures 28, 29) [locality: V–17–14RD].

Magadina cumingi (Davidson): 39–40, Interior and exterior of a dorsal valve (partially restored), showing thick cardinalia and outline, × 2, hypotype USNM 550553 [locality: V–18–107]. 41, Exterior of a complete specimen, showing bouchardiiform beak, × 1, hypotype USNM 465460a; 42, interior of a dorsal valve showing the loop, × 3, hypotype USNM 128938 [locality: Sow and Pig Reef, Port Jackson, New South Wales, Australia].

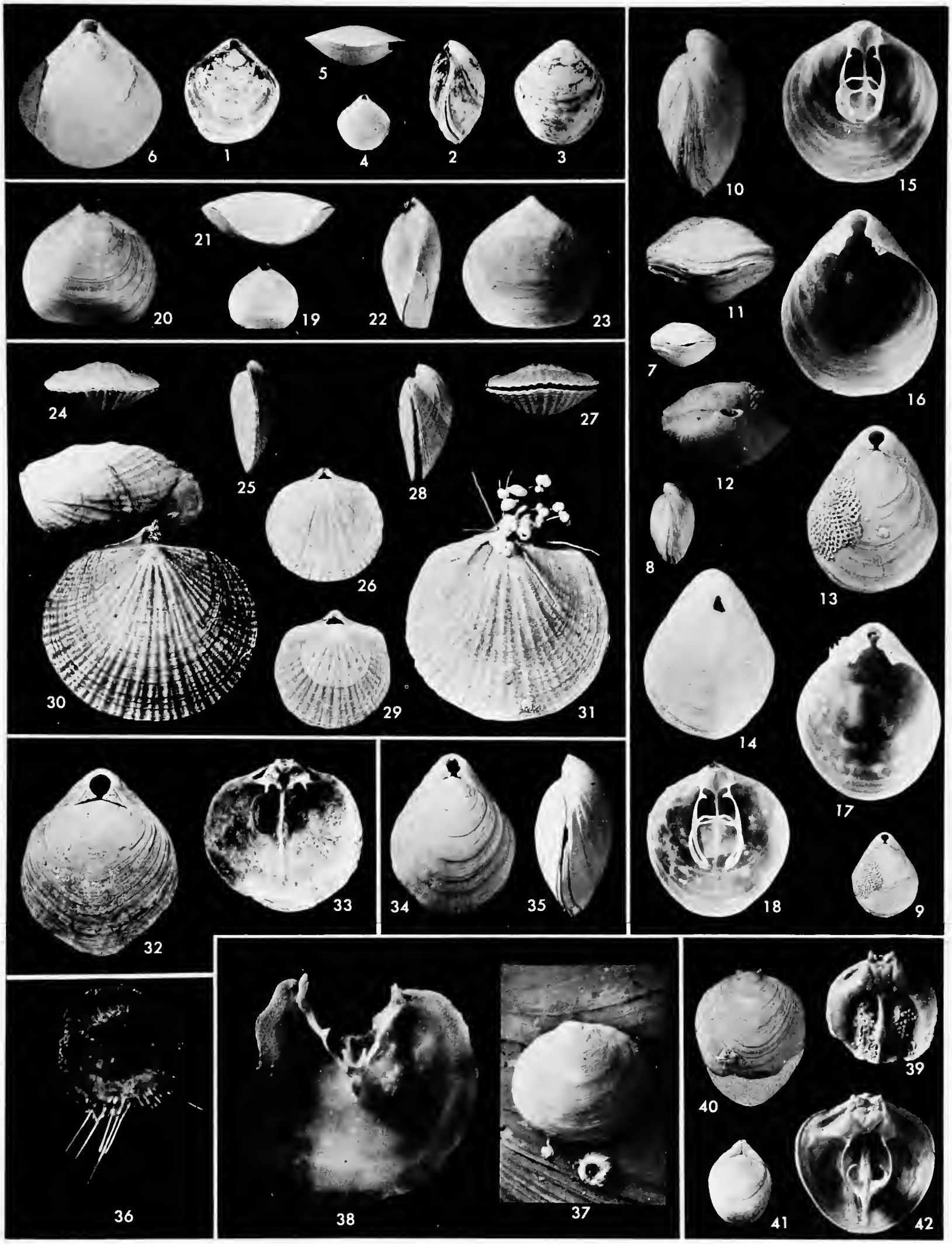

6
1
5
4
2
3
20
21
19
22
23
24
25
28
27
26
30
29
31
10
15
11
16
7
12
8
13
14
17
18
9
32
33
34
35
36
38
37
40
39
41
42

PLATE 6

Genus undetermined, *Terebratella, Liothyrella,* and *Aneboconcha*

Genus and species undetermined = immature terebratellid: 1–4, Side, ventral, dorsal, and posterior views of the holotype showing open delthyrium of the ventral valve, × 10, USNM 550502a; 5–8, anterior, side, ventral, and dorsal views of a crushed specimen, × 10, paratype USNM 550502b; 9, interior of the dorsal valve preserving the simple lophophore, × 20, paratype USNM 550502d; 10, 11, ventral and side views of the dorsal valve interior, showing the short, triangular septum, the short oblique crus, and deep socket, × 10, paratype USNM 550502c; 12, interior of the same specimen, showing the pits in the inner layer, × 20 [locality: Theta–1–6].

Genus and species undetermined: 13, Dorsal view of the single specimen, figured specimen, × 1, USNM 550509; 14–16, anterior, dorsal, and side views of the same specimen, × 2 [locality: V–17–RD14].

Terebratella dorsata (Gmelin): 17–19, Anterior, dorsal, and side views of three small adults, × 1, hypotypes USNM 550512c, d, b; 20–22, side, dorsal, and ventral views of the largest specimen in the collection, × 1, hypotype USNM 550512a [locality: V–17–77].

Liothyrella uva (Broderip): 23-27, Dorsal, posterior, anterior, side, and ventral views of a large adult, × 1, hypotype USNM 550493; 28, 29, interior of the dorsal valve of the same specimen, showing the wide loop, × 1, × 2 [locality: V–18–12].

Aneboconcha obscura, new species: 30–33, Dorsal valve interior of an immature specimen, showing the initial ring and pillar, in posteriorly tilted, anterior, ventral, and laterally tilted views, × 10, paratype USNM 550513; 34, enlargement of the same specimen of the posteriorly tilted view to show the initial ring, × 20; 35, interior of the ventral valve of the preceding specimen, × 10 [locality: V–18–16].

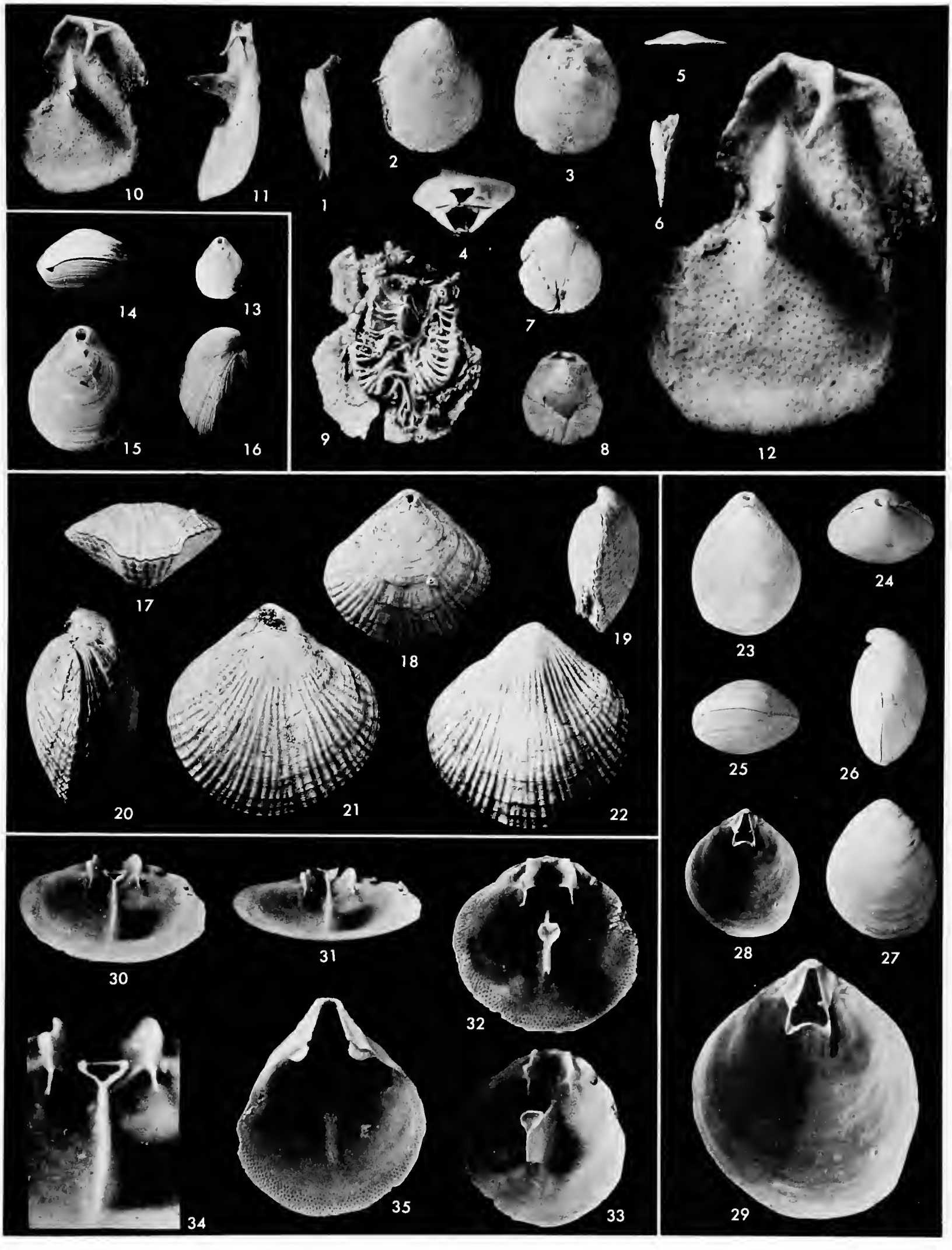

10
11
1
2
3
5
6
4
14
13
7
9
8
12
15
16
17
18
19
20
21
22
24
23
25
26
28
27
30
31
32
29
34
35
33

PLATE 7

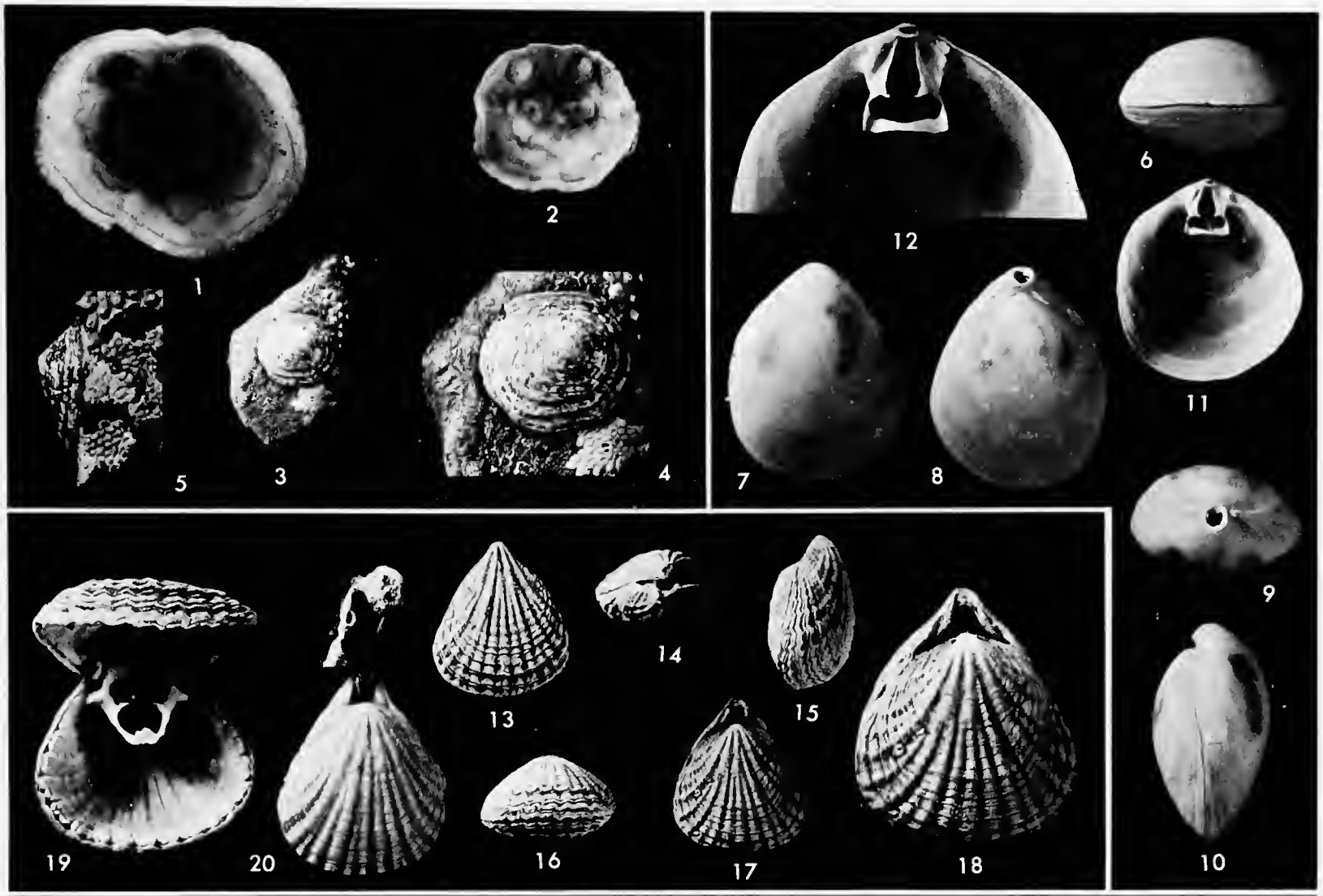
Crania, Liothyrella, Eucalathis, and *Magellania*

Crania patagonica Dall: 1, Interior of the dorsal valve with flesh in place, showing muscles as dark spots, × 3, hypotype USNM 550506 [locality: V–17–12]. 2, Interior of another dorsal valve, showing muscle impressions on the shell, × 2, hypotype USNM 550482c; 3, dorsal view of a specimen attached to a bryozoan-coated pebble, × 1, hypotype USNM 550482a; 4, 5, side and dorsal views of the preceding specimen, × 2 [locality: Y–2–8].

Liothyrella uva (Broderip): 6–10, Anterior, ventral, dorsal, posterior, and side views of a large individual, × 1, hypotype USNM 550491; 11, 12, interior of the dorsal valve of the hypotype, showing the loop with its narrow, concave outer hinge plates and marginal, elevated crural bases, × 1, × 2 [locality: V–15–102].

Eucalathis inflata, new species: 13–17, Ventral, posterior, side, anterior, and dorsal views of the holotype, × 3, USNM 550479a; 18, dorsal exterior of the holotype, showing the ornament in detail, × 5; 19, the holotype opened to show the loop, × 5 (for additional views of this unusual loop see Plate 4: figures 11–13); 20, a paratype showing the long frayed pedicle, × 4, paratype USNM 550479b [locality: V–17–RD14].

Magellania venosa (Solander): 21–23, Anterior, dorsal, and side views of a large and typical specimen, × 1, hypotype USNM 550466 [locality: V–14–5]. 24, Dorsal view of a nearly equidimensional specimen, × 1, hypotype USNM 550467 [locality: V–15–102]. 25, Dorsal valve interior, showing early loop stage in which the descending branches have not quite joined the septal pillar and the ring is not yet completely closed, premagadiniform stage, × 5, hypotype USNM 550474b; 26, interior of another immature dorsal valve, showing ring complete and descending branches attached to the septal pillar, early magelliform stage, × 3, hypotype USNM 550474c; 27, an immature terebratelliform stage of another young specimen, × 3, hypotype USNM 550474f [locality: V–17–47]. 28, A still more advanced magelliform stage in the development of the loop than the preceding, × 3, hypotype USNM 550507 [locality: V–16–39]. 29, Interior of a large adult, showing the delicate ribbons of the complete, free loop of the adult, × 1, hypotype USNM 550468 [locality: V–16–37].


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20


21
22
23
24
25
26
27
28
29

PLATE 8

Argyrotheca, Macandrevia, Cryptopora, Terebratulina, Agulhasia, and Megerlina

Argyrotheca thurmanni new species: 1–5, Dorsal, posterior, side, ventral, and anterior views of the holotype, × 6, USNM 550560a; 6–10, anterior, dorsal, side, posterior, and ventral views of a smaller paratype, × 6, USNM 550660b; 11, interior of the dorsal valve, showing the massive thickening between loop and posterior, × 12, paratype USNM 550560c [locality: V–15–138].

Macandrevia cf. *M. diamantina* Dall: 12, 13, Interior and side views of the dorsal valve, showing the long loop, anteriorly spinose, × 2, hypotype USNM 550557 [locality: V–15–38].

Cryptopora gnomon (Jeffreys): 14, Dorsal view of a complete specimen photographed in alcohol, showing circinate lophophore and median septum, × 8, hypotype USNM 550555c; 15, interior of the dorsal valve, showing the maniculifer crura and high median septum, × 8, hypotype USNM 550555b; 16, dorsal view of a complete specimen, showing the narrow, elevated deltidial plates characteristic of the species, × 8, hypotype USNM 550555a [locality: V–16–52].

Terebratulina latifrons Dall: 17, Dorsal view of small, complete specimen, × 3, hypotype USNM 550554 [locality: V–15–138].

Agulhasia davidsoni King: 18–21, Ventral, anterior, side, and dorsal views of a complete specimen, × 6, hypotype USNM 550551a; 22, 23, interior of the ventral and dorsal valves, showing apical plate in beak region of the ventral valve and the large cardinal process in the dorsal valve, × 6, hypotypes USNM 550551b, c [locality. V–19–28]. 24, Interior of a dorsal valve, showing the long, narrow, and anteriorly rounded loop, hypotype USNM 549456 [locality: Agulhas Bank, South Africa].

Megerlina natalensis (Krauss): 25, Dorsal view of a complete specimen, × 1, hypotype USNM 550561a; 26–30, dorsal, side, posterior, anterior, and ventral views of the preceding specimen, showing keeled ventral valve and sulcate anterior commissure, × 2, 31, interior of the preceding specimen, showing prongs of brachidium attached to the median septum, × 2; 32, 33, exterior and interior views of a dorsal valve, showing brachidium, × 2, hypotype USNM 550561b [locality: V–14–Sat 3].

Terebratulina abyssicola (Adams and Reeve): 34–37, Anterior, side, ventral, and dorsal views of a complete specimen, showing narrowly folded anterior commissure, × 1, hypotype USNM 550548b; 38, dorsal view of the preceding specimen, showing nearly conjunct deltidial plates, × 2; 39–42, anterior, dorsal, side, and ventral views of a specimen larger than the preceding, × 1, hypotype USNM 550548a; 43, dorsal view of the preceding specimen, showing conjunct deltidial plates, × 2 [locality: V–19–31].

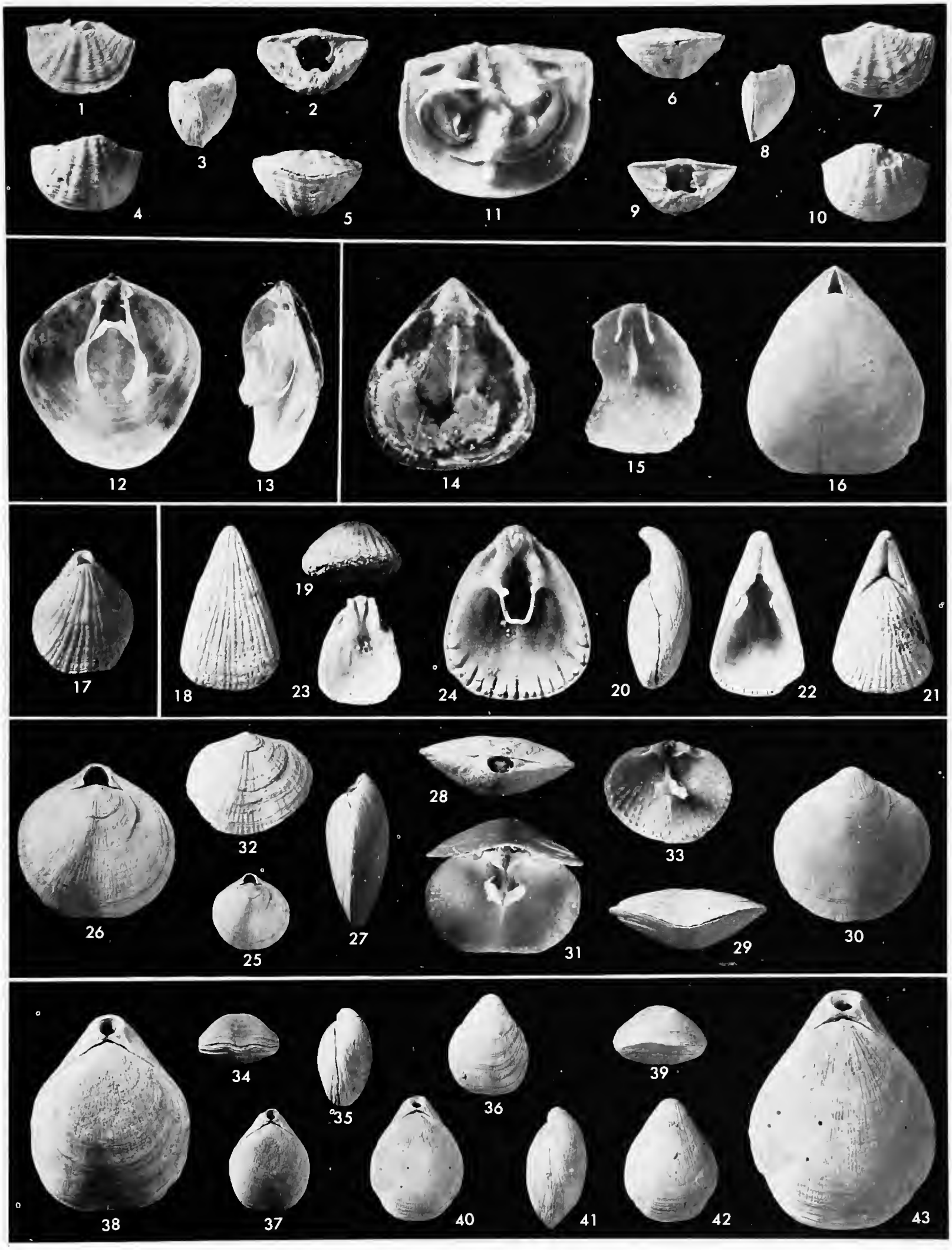

1
2
3
4
5
11
6
7
8
9
10
12
13
14
15
16
17
18
19
23
24
20
22
21
26
32
25
27
28
31
33
29
30
38
34
35
37
36
39
40
41
42
43

PLATE 9

Kraussina, Abyssothyris, Megerlina, and Platidia

Kraussina crassicosta Jackson: 1–5, Posterior, anterior, side, ventral, and dorsal views of a complete specimen, showing large foramen and sulcate anterior commissure, × 1, hypotype USNM 550549a; 6, 7, interior views of the ventral and dorsal valves, × 1, hypotypes USNM 550549b, c; 8, 9, the same views of the same specimen, showing teeth, cardinalia and muscle scars but not brachidium, × 2 [locality: V–19–31].

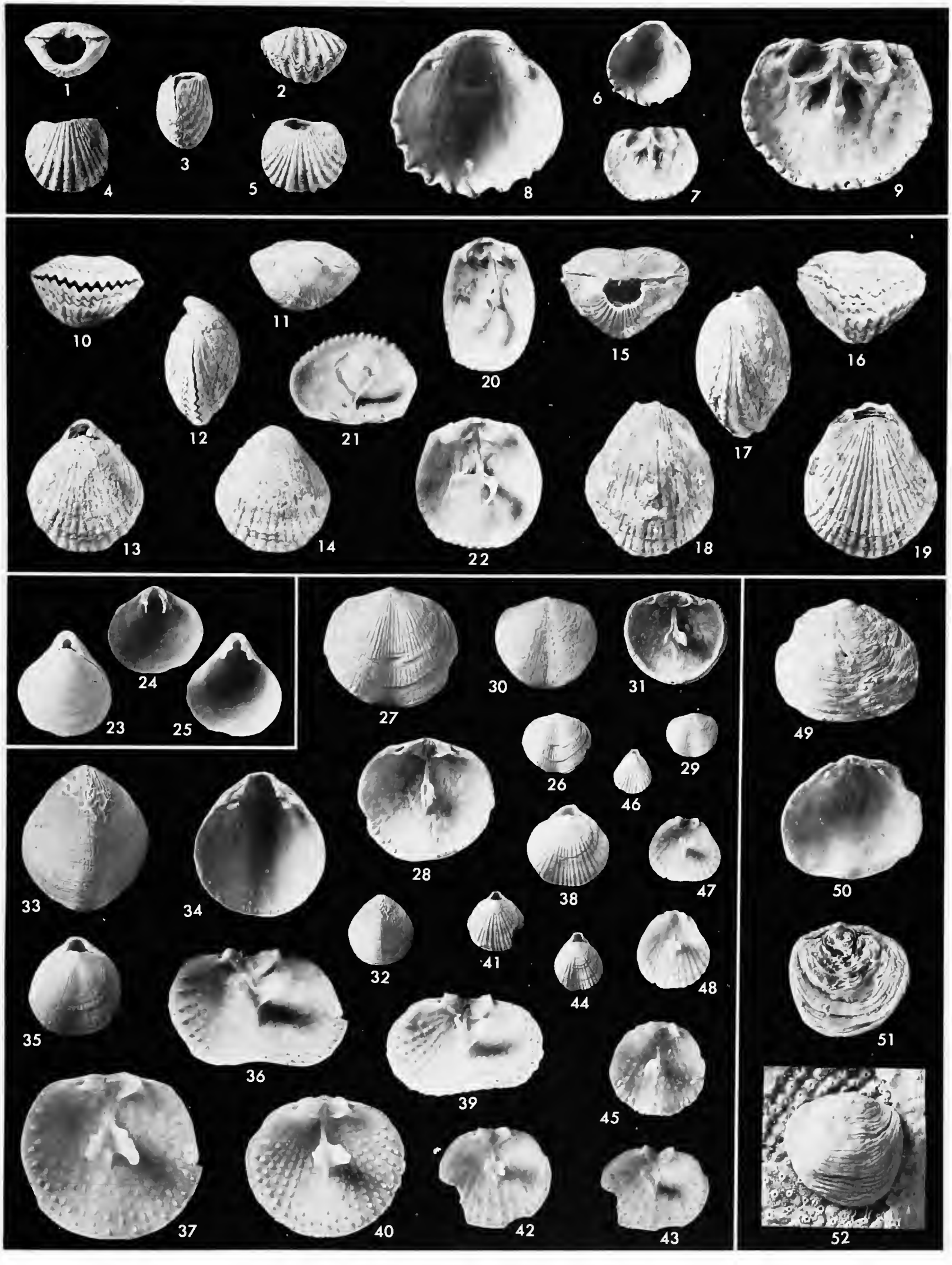
Kraussina rubra (Pallas): 10–14, Anterior, posterior, side, dorsal, and ventral views of a specimen with well-formed beak, × 1, hypotype USNM 550547b; 15–19, posterior, anterior, side, ventral, and dorsal views of an elongated individual with well-worn beak, × 1, hypotype USNM 550547a; 20–22, partial side, posterior, and interior views of a dorsal valve with complete brachidium, showing posterior, thin projections as well as the stouter anterior processes, × 1, hypotype USNM 550547c [locality: V–14–Sat 3].

Abyssothyris species: 23, Dorsal view of a complete specimen, × 3, figured specimen USNM 550552; 24, 25, dorsal and ventral interiors of the same specimen, × 3 [locality: V–15–126].

Megerlina striata Jackson: 26–28, Dorsal exterior, × 1, and the same dorsal exterior and interior, × 2, showing cardinalia, hypotype USNM 550558a; 29–31, dorsal exterior, × 1, and the same dorsal exterior and interior, × 2, showing brachidium and cardinalia, hypotype USNM 550558b; 32–34, ventral valve exterior, × 1, and exterior and interior views of the same specimen, × 2, showing teeth and small deltidial plates, holotype USNM 550558c; 35, exterior of a small specimen, showing both valves, × 2, hypotype USNM 550558d; 36, 37, partial anterior and interior view of the dorsal valve of the preceding specimen, showing the brachidium, × 4; 38–40, dorsal view, × 2, and anterior and interior views, × 4, of the dorsal valve of the same specimen, showing brachidium, hypotype USNM 550558e; 41–43, dorsal exterior, × 2, and anterior and interior views, × 4, of a specimen younger than the preceding, and showing the developing brachidium, hypotype USNM 550558f; 44, 45, dorsal view of a small, complete specimen, × 2, and the interior of its dorsal valve, × 4, hypotype USNM 550558g; 46–48, dorsal view of a very young specimen, × 2, and anterior and interior views of its dorsal valve, showing the early beginnings of the brachidium, × 4, hypotype USNM 550558h [locality: V–19–28].

Platidia anomioides (Scacchi and Philippi): 49, 50, Exterior and interior of a large ventral valve, × 6, hypotype USNM 550559b; 51, dorsal view of specimen, preserving both valves, × 6, hypotype USNM 550559a; 52, ventral view of the preceding specimen while attached to a fragment of bryozoan colony, × 6 [locality: V–19–28].

☆ U. S. GOVERNMENT PRINTING OFFICE: 1973—484–322/41


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52

Publication in *Smithsonian Contributions to Paleobiology*

Manuscripts for serial publications are accepted by the Smithsonian Institution Press, subject to substantive review, only through departments of the various Smithsonian museums. Non-Smithsonian authors should address inquiries to the appropriate department. If submission is invited, the following format requirements of the Press will govern the preparation of copy.

Copy must be typewritten, double-spaced, on one side of standard white bond paper, with 1½" top and left margin, submitted in ribbon copy with a carbon or duplicate, and accompanied by the original artwork. Duplicate copies of all material, including illustrations, should be retained by the author. There may be several paragraphs to a page, but each page should begin with a new paragraph. Number consecutively all pages, including title page, abstract, text, literature cited, legends, and tables. The minimum length is 30 pages, including typescript and illustrations.

The *title* should be complete and clear for easy indexing by abstracting services. Taxonomic titles will carry a final line indicating the higher categories to which the taxon is referable: "(Ammonoidea: Goniatitidae)." Include an *abstract* as an introductory part of the text. Identify the *author* on the first page of text with an unnumbered footnote that includes his professional mailing address. A *table of contents* is optional. An *index,* if required, may be supplied by the author when he returns page proof.

Two *headings* are used: (1) text heads (boldface in print) for major sections and chapters and (2) paragraph sideheads (caps and small caps in print) for subdivisions. Further headings may be worked out with the editor.

In *taxonomic keys,* number only the first item of each couplet; if there is only one couplet, omit the number. For easy reference, number also the taxa and their corresponding headings throughout the text; do not incorporate page references in the key.

In *synonymy,* use the short form (taxon, author, date:page) with a full reference at the end of the paper under "Literature Cited." Begin each taxon at the left margin with subsequent lines indented about three spaces. Within an entry, use a period-dash (.—) to separate each reference. Enclose with square brackets any annotation in, or at the end of, the entry.

For *references within the text,* use the author-date system: "(Jones, 1910)" and "Jones (1910)." If the reference is expanded, abbreviate the data: "Jones (1910:122, pl. 20: fig. 1)."

Simple *tabulations* in the text (e.g., columns of data) may carry headings or not, but they should not contain rules. Formal *tables* must be submitted as pages separate from the text, and each table, no matter how large, should be pasted up as a single sheet of copy.

Use the *metric system* instead of, or in addition to, the English system.

Illustrations (line drawings, maps, photographs, shaded drawings) can be intermixed throughout the printed text. They will be termed *Figures* and should be numbered consecutively; however, if a group of figures is treated as a single figure, the components should be indicated by lowercase italic letters on the illustration, in the legend, and in text references: "Figure 9*b*." If illustrations (usually tone photographs) are printed separately from the text as full pages on a different stock of paper, they will be termed *Plates,* and individual components should be lettered (Plate 9*b*) but may be numbered (Plate 9: figure 2). Never combine the numbering system of text illustrations with that of plate illustrations. Submit all legends on pages separate from the text and not attached to the artwork. An instruction booklet for the preparation of illustrations is available from the Press on request.

In the *bibliography* (usually called "Literature Cited"), spell out book, journal, and article titles, using initial caps with all words except minor terms such as "and, of, the." For capitalization of titles in foreign languages, follow the national practice of each language. Underscore (for italics) book and journal titles. Use the colon-parentheses system for volume, number, and page citations: "10(2):5-9." Spell out such words as "figures," "plates," "pages."

For *free copies* of his own paper, a Smithsonian author should indicate his requirements on "Form 36" (submitted to the Press with the manuscript). A non-Smithsonian author will receive 50 free copies; order forms for quantities above this amount with instructions for payment will be supplied when page proof is forwarded.